This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

B 427150

1837
ARTES
VERITAS
SCIENTIA
LIBRARY OF THE
UNIVERSITY OF MICHIGAN
E PLURIBUS UNUM
TUEBOR
SI QUAERIS PENINSULAM AMOENAM
CIRCUMSPICE

TS
1550
.N2

NEW ENGLAND

Cotton Manufacturers' Association.

Proposal for

.....

Membership of

Notice to Members.

To make the Cotton Manufacturers' Association an absolutely representative body it must include as many as possible of those who are eligible for membership. It has been found that many who were eligible and desired to join had not done so because not invited. It is hoped that every member will present the matter to non-members among his associates. The accompanying blank proposition for membership can be detached from the cover at the row of perforations.

NEW ENGLAND

Cotton Manufacturers' Association.

Proposal for

.....

Membership of

.....

Application Received

.....189 .

Action by Board of Government,..... favorable.

.....189 .

Voted by the Association, ... elected,

.....189 .

New England
Cotton Manufacturers' Associa.

Room 57, International Trust Building,

45 MILK STREET,

BOSTON, MASS.

PROPOSAL FOR MEMBERSHIP.

(When filled out, to be mailed to the Secretary, P. O. Box 3672, Boston, Mass., in time for action by the Board of Government, at least one week before a meeting of the Association.)

Mr. .....

Position, ...

P. O. Address, ...

is proposed for ..... *membership in the* NEW ENGLAND COTTON
active or associate

MANUFACTURERS' ASSOCIATION *by* .....
signature of member proposing candidate.

a member of the Association.

Experience of Applicant, (Please state, in full, particulars of detail, giving names, dates, and nature of work, as fully as convenient.)

.....

.....

.....

.....

.....

.....

.....

.....

.....

The undersigned certifies that the above statements are correct, and agrees that, if elected to the Association, he will be governed by its rules as long as his connection with it shall continue.

Date, ... 189 .

signature of candidate.

NEW ENGLAND COTTON MANUFACTURERS ASSOCIATION

TRANSACTIONS

OF THE

New England

COTTON MANUFACTURERS' ASSOCIATION.

Founded April 20, 1865. Incorporated Dec. 1, 1894.

NO. 66.

ANNUAL MEETING.

Held in Chipman Hall, 88 Tremont Street, Boston, Mass.,

APRIL 27-29, 1899.

Office of the Association:

Room 57, International Trust Building, 45 Milk Street,
Corner of Devonshire St., Boston, Mass.

WALTHAM, MASS.:

PRESS OF E. L. BARRY,

1899.

ENTERED ACCORDING TO ACT OF CONGRESS
IN THE YEAR 1899
BY THE NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION,
IN THE OFFICE OF THE LIBRARIAN OF CONGRESS
AT WASHINGTON.

By vote of the Board of Government, the price of the *Transactions* is $5.00 per copy to non-members. The price of this issue and the one previous is $1.00 each to members, and the prices of copies previous to Volume 61, is 50 cents to members, but each member is entitled to a copy as a part of the privilege of membership.

CHARTER.

No. 6091.

Commonwealth of Massachusetts.

BE IT KNOWN, That whereas, EDWARD W. THOMAS, C. J. H. WOODBURY, WILLIAM J. KENT, F. M. MESSENGER, HARRY T. WHITIN, ARTHUR H. LOWE, ALBERT F. KNIGHT, ALFRED M. GOODALE, FRED C. MCDUFFIE and GEORGE W. BEAN have associated themselves with the intention of forming a corporation under the name of the NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION, for the purpose of encouraging scientific investigation and experiment as to the methods of manufacturing cotton; collecting and imparting information relating to this industry, promoting social intercourse among its members; and establishing and maintaining a library of works on textiles in the city of Boston, and have complied with the provisions of the Statutes of this Commonwealth in such case made and provided, as appears from the certificate of the President, Treasurer and Directors of said corporation, duly approved by the Commissioner of Corporations, and recorded in this office.

Now, Therefore, I, WILLIAM M. OLIN, Secretary of the Commonwealth of Massachusetts, do hereby certify that said EDWARD W. THOMAS, C. J. H. WOODBURY, WILLIAM J. KENT, F. M. MESSENGER, HARRY T. WHITIN, ARTHUR H. LOWE, ALBERT F. KNIGHT, ALFRED M. GOODALE, FRED C. MCDUFFIE and GEORGE W. BEAN, their associates and successors, are legally organized and established as and are hereby made an existing corporation under the name of the

NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION,

with the powers, rights and privileges, and subject to the limitations, duties and restrictions which by law appertain thereto.

Seal of the Commonwealth of Massachusetts.

Witness my official signature hereunto subscribed, and the seal of the Commonwealth of Massachusetts hereunto affixed this first day of December, in the year of our Lord one thousand eight hundred and ninety-four.

WILLIAM M. OLIN,

Secretary of the Commonwealth.

197006

Commonwealth of Massachusetts.

(Acts of 1895, Chap. 163.)

AN ACT TO AUTHORIZE THE NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION TO HOLD ITS MEETINGS WITHOUT THE COMMONWEALTH.

Be it enacted, etc., as follows:

SECTION 1. The New England Cotton Manufacturers' Association is hereby authorized to hold its meetings in any state or territory of the United States and in the District of Columbia; provided, however, that its annual meeting shall be held in this Commonwealth at least once in five years.

SECT. 2. This act shall take effect upon its passage. [Approved March 23, 1895.]

NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION.

FOUNDED APRIL 20, 1865.

INCORPORATED DECEMBER 1, 1894.

CONSTITUTION AND BY-LAWS.

ACTIVE MEMBERS.

ARTICLE 1. Any person who is actively engaged as President, Treasurer, Agent, Superintendent or Manager in the manufacture, printing or finishing of cottons shall be eligible for active membership.

ELECTION OF MEMBERS.

ARTICLE 2. All nominations for membership shall be made in writing, at least one week before the date of any regular meeting, and shall be considered by the Board of Government, and reported to the meeting, favorably or adversely, for the action of the Association. *Provided*, that in case the Board shall decide to report adversely upon any nomination, the member who shall have made it shall be informed of the intention so to report, in order that he may have an opportunity to withdraw the name. Upon such report active members may be admitted, if they obtain a majority of votes of the members present and voting therefor, by acceptance in writing, and paying an admission fee of ten dollars, and maintaining their membership by the payment of an annual assessment not exceeding ten dollars. Any member failing to pay two successive assessments shall cease to be a member at the end of six months from the date when such second assessment shall become due. Any member may withdraw from the Association upon payment of all arrearages, first giving notice of his intention so to do, in writing, to the Secretary, and the Board of Government may accept such resignation; and any member may be expelled for cause,

at any regular meeting, two-thirds of the members present voting therefor.

ASSOCIATE MEMBERS.

ARTICLE 3. Persons engaged in the manufacture of cotton or cotton fabrics, or the manufacture of textile machinery, or industries kindred to the cotton manufacture, may become associate members of the Association. The methods of application, nomination, election and withdrawal from the Association being under the same conditions as those provided for active members in Article 2, excepting that this class of membership does not carry with it the privilege of voting or speaking, except by permission from the Board of Government or a vote of the Association to allow permission.

The initiation fee for associate members shall be twenty-five dollars, and the annual assessment shall be double the sum annually voted for active members.

Associate members may be expelled by a majority vote of the Board of Government.

HONORARY MEMBERS.

ARTICLE 4. Honorary members may be elected, when recommended by the Board of Government, at any regular meeting of the Association, who shall be enrolled as such, and shall be entitled to attend the meetings of the Association and participate in its proceedings, without the right to vote. They shall not be subject to payment of admission fees or assessments. No person actively engaged in cotton manufacture shall be eligible to honorary membership.

ARTICLE 5. It shall be the duty of all members of the Association to make returns to the Secretary of such statistics as may be called for by him, under the direction of any committee duly appointed for the collection of statistics, when not incompatible with private interests.

OFFICERS.

ARTICLE 6. The officers of this Association shall be a President, two Vice-Presidents, six Directors, a Treasurer, Secretary, and Auditor of Accounts.

ELECTION OF OFFICERS.

ARTICLE 7. At each annual meeting there shall be chosen by ballot a President, two Vice-Presidents and two Directors; the President and Vice-Presidents to serve one year, and the two Directors shall be chosen for terms of three years.

DUTIES OF OFFICERS.

ARTICLE 8. The President, or in his absence the senior Vice-President present, shall preside at all meetings of the Association and of the Board of Government. All officers shall hold their respective offices until their successors shall be chosen and accept their positions.

ARTICLE 9. The President, Vice-Presidents and Directors shall constitute a Board of Government, and have under their care and direction all matters pertaining to the management of the Association; and five of their number shall constitute a quorum for the transaction of business. Meetings of the board may be called by the President, at such time and place as he may deem expedient, giving each member a written or printed notice of the same at least five days before the day of meeting. At their first meeting the board shall elect a Treasurer, Secretary, and Auditor of Accounts for the year ensuing, and fix the amount of compensation of the Secretary. All vacancies in their board occasioned by death or resignation shall be filled by the board; and the persons so elected shall hold their offices until the next annual meeting. The board may, from time to time, as they shall deem expedient, appoint committees, from among their own board or from the members at large, to collect statistical information, examine new inventions or processes in manufacturing goods, as also to prepare essays on subjects of interest to the Association.

ARTICLE 10. The Treasurer shall keep a book in which all receipts and payments of money shall be entered, collect all moneys due the Association, and disburse the same upon the written order of the Board of Government. At the annual meeting in each year he shall make an exhibit of his accounts, or oftener if the Board of Government require it. He shall notify the members of assessments voted, and cause them to be collected in a reasonable time.

ARTICLE 11. The Secretary shall attend all meetings of the Association and of the Board of Government, and keep accurate records of

their doings. In the absence of the Secretary at any meeting, a Secretary *pro tem.* may be appointed by the presiding officer, who shall be sworn to do all things, while in office, required of the Secretary.

ARTICLE 12. The Auditor shall examine the accounts of the Treasurer annually, and report at each meeting the state of the finances.

MEETINGS.

ARTICLE 13. The annual meeting of the members of the Association shall be held on the last Wednesday of April, or at such other time, and at such hour and place as the Board of Government may appoint. There shall also be a semi-annual meeting of the Association on the last Wednesday of October, in each and every year, or at such other time, and at such place and hour as the Board of Government may appoint.

Special meetings may be called by the Board of Government whenever they deem it expedient, or upon the written application of any ten members, made to the Secretary.

ARTICLE 14. All meetings of the members of the Association shall be in pursuance of a written or printed notice, addressed to each member, with the name of the President or Secretary attached thereto, and deposited in the Post Office ten days at least before the day of meeting, specifying the time and place of meeting; and at all such meetings fifteen members shall constitute a quorum for the transaction of business.

ARTICLE 15. Amendments to the By-Laws may be made at any stated meeting of the Association by a two-thirds vote; *provided,* notice of such proposed amendment be given in writing at a previous meeting, and also notice be given to each member by the Secretary, of the pendency of such amendment, ten days at least before any such meeting.

BOARD OF GOVERNMENT.

1899.

PRESIDENT.

FREDERICK E. CLARKE, ... LAWRENCE, MASS.

VICE-PRESIDENTS.

FRED C. McDUFFIE, ... BOSTON, MASS.
HENRY T. WHITIN, ... NORTHBRIDGE, MASS

DIRECTORS.

ALFRED E. ADAMS, ... WHITINSVILLE, MASS.
GEORGE H. HILLS, ... FALL RIVER, MASS.
JOHN TEMPEST MEATS, ... TAUNTON, MASS.
CHAS. H. RICHARDSON, ... CLINTON, MASS.
A. TENNY WHITE, ... MANVILLE, R. I.
GEORGE F. WHITTEN, ... MANCHESTER, N. H.

AUDITOR.

J. HERBERT SAWYER, ... BOSTON, MASS.

SECRETARY.

C. J. H. WOODBURY, P. O. Box 3672, BOSTON, MASS.

OFFICE OF THE ASSOCIATION:

ROOM 57, INTERNATIONAL TRUST BUILDING, 45 MILK STREET, CORNER OF DEVONSHIRE STREET, BOSTON, MASS.

OFFICERS OF THE ASSOCIATION,

FROM THE FIRST ORGANIZATION.

PRESIDENTS.

Ezekiel A. Straw,	1865–78	Robert McArthur,	1892–94
Amos D. Lockwood,	1878–80	Edw. W. Thomas,	1894–95
John Kilburn,	1880–83	A. M. Goodale,	1895–96
William C. Lovering,	1883–85	Arthur H. Lowe,	1896–97
Richard Garsed,	1885–86	Russell W. Eaton,	1897–98
J. S. Ludlam,	1886–88	Stephen A. Knight,	1898–99
Henry F. Lippitt,	1888–89	FRED'K E. CLARKE,	1899–
Walter E. Parker,	1889–92		

VICE-PRESIDENTS.

Amos D. Lockwood,	1865–77	Walter E. Parker,	1885–89
William A. Burke,	1865–73	Richard B. Borden,	1886–88
John C. Palfrey,	1873–76	Arnold B. Sanford,	1888–91
Edward Atkinson,	1876–78	Robert McArthur,	1889–92
A. G. Cumnock,	1877–80	Simeon B. Chase,	1891–93
Charles Nourse,	1878–81	E. W. Thomas,	1892–94
William F. Goulding,	1880–83	A. M. Goodale,	1893-95
Richard Garsed,	1881–85	William J. Kent,	1894–97
J. S. Ludlam,	1883–86	FRED. C. McDUFFIE,	1895–
		HENRY T. WHITIN,	1897–

DIRECTORS.

J. S. Davis,	1865–69
Charles Nourse,	1865–78
Phineas Adams,	1865–74
William P. Haines,	1865–69
Thomas J. Borden,	1865–78
Daniel D. Crombie,	1865–68
Cyrus I. Barker,	1875–80
Hervey Kent,	1877–81
David J. Johnston,	1878–82
Walter Paine, 3d,	1878–80
Chas. L. Lovering,	1878–83
Richard Garsed,	1880–81
William H. Jennings,	1880–83
Chas. D. McDuffie,	1881–83
Walter E. Parker,	1881–85
John W. Danielson,	1881–85
William E. Barrows,	1882–83
Rufus A. Maxfield,	1883–86
George W. Weeks,	1883–86
Henry S. Howe,	1883–87
Richard B. Borden,	1883–86
O. S. Brown,	1885–91
Henry F. Lippitt,	1885–88
Wilbur A. Stiles,	1886–88
Stephen N. Bourne,	1886–91
John Kilburn,	1870–80
William P. Haines,	1874–78
Robert McArthur,	1886–89
A. M. Wade,	1868–69
D. J. Johnston,	1869–70
A. G. Cumnock,	1869–77
F. E. Clarke,	1869–75
S. S. Spencer,	1887–90
E. W. Thomas,	1888–92
William W. Whitin,	1888–93
Robert R. Smith,	1889–92
Alfred M. Goodale,	1890–93
William J. Kent,	1891–94
Herman F. Straw,	1891–93
Fred C. McDuffie,	1892–95
George W. Bean,	1892–95
F. M. Messenger,	1893–95
Arthur H. Lowe,	1894–96
Henry T. Whitin,	1894–97
Herbert L. Pratt,	1895–98
Stephen A. Knight,	1895–98
Russell W. Eaton,	1896–97
Albert F. Knight,	1893–99
John Eccles,	1895–99
C. H. RICHARDSON,	1897–
GEORGE H. HILLS,	1897–
JOHN T. MEATS,	1898–
GEO. F. WHITTEN,	1898–
A. TENNY WHITE,	1899–
ALFRED E. ADAMS,	1899–

AUDITORS.

BENJAMIN SAUNDERS, .	1865–71	HENRY D. SULLIVAN, .	1873–82
JOHN C. PALFREY, .	1871–73	J. HERBERT SAWYER,	1882

SECRETARY AND TREASURER.

AMBROSE EASTMAN, .	1865–94	C. J. H. WOODBURY,	1894

MEMBERS OF THE ASSOCIATION.

May 1, 1899.

Members of the Association are respectfully requested to scrutinize the following list, and advise the Secretary, P. O. Box 3672, Boston, Mass., of change in address, or any error in regard to their names.

As a number of members rejoined the Association after severing their first membership, the date of their earliest election is given.

HONORARY MEMBERS.

George Arms	Grand Hotel	New York City	Oct. 16, 1872.
Jones S. Davis	6 Newton St.,	Holyoke, Mass.	Oct. 27, 1897.
Ambrose Eastman	53 State St.	Boston, Mass.	Sept. 27, 1894.
Samuel Webber	Hydraulic Engineer	Charlestown, N. H.	Apr. 28, 1897.

ACTIVE MEMBERS.

Alfred E. Adams	Agt. Whitinsville Cotton Mills, Agt. Linwood Mills	Whitinsville, Mass.	Apr. 27, 1887.
John S. Adams, Jr.	Supt. Adams Bros. Mfg. Co.	35 Grove St., Adams, Mass.	Apr. 29, 1896.
Stephen L. Adams	Treas. Stafford Mfg. Co.	Central Falls, R. I.	Apr. 24, 1895.
Joseph D. Aiken	Ponemah Mills	Taftville, Conn.	Oct. 28, 1891.
F. S. Akin	Supt. Cornell Mills	Fall River, Mass.	Sept. 27, 1894.
Charles T. Aldrich	Treas. Aldrich Mfg. Co.	Box 34, Providence, R. I.	Apr. 28, 1886.
B. A. Alexander	Supt. Boston Duck Co.	Bondsville, Mass.	Apr. 28, 1898.
George E. Ames	Mech. Supt. Lawrence Mfg. Co.	Lowell, Mass.	Apr. 24, 1895.
William Ames	Treas. Fletcher Manufg. Co., Box 83,	47 Charles St., Providence, R. I.	Apr. 30, 1879.
Charles B. Amory	Treas. Hamilton Manufg. Co.	70 Kilby St., Boston, Mass.	Apr. 25, 1894.
Frederic Amory	Treas. Nashua Mfg. Co. Treas. Jackson Mfg. Co.	40 Water St., Boston, Mass.	Apr. 27, 1899.
Thomas Armstrong	Supt. No. Pownal Mfg. Co.	No. Pownal, Vt.	Oct. 27, 1897.

John W. Arrington . . . . . Box 283, 106 South 13th St., Richmond, Va. . . . Oct. 24, 1895.
Abel T. Atherton . . . Machine Maker . . . . . Bay Side, R. I. . . . Oct. 16, 1872.
Edward Atkinson . . . Prest. Boston Mfrs. Mu. Fire Ins. Co. . . . . .
. . . . . 31 Milk St., Boston, Mass. . . . Apr. 19, 1871.
E. W. Atkinson . . . . Stoddard, Haserick, Richards & Co. . . . . .
. . . . . 152 Congress St., Boston, Mass. . Oct. 27, 1886.
H. C. Atwood . . . . Treas. Williamsville Manufg. Co. . . Providence, R. I. . . Apr. 29, 1885.
James A. Atwood . . . Agt. Wauregan Mills and Quinebaug Co. . . . . .
. . . . . Wauregan, Conn. . . Oct. 28, 1891.
John Walter Atwood . Supt. Wauregan Mills . . . . . Wauregan, Conn. . . Oct. 24, 1895.
W. E. Atwood . . . . Secy. and Asst. Treas. Williamsville Manufg. Co. . . . . .
. . . . . Killingly, Conn. . . . Sept. 27, 1894.
George A. Ayer . . . Supt. City Manufg. Corporation . . . . . .
. . . . . 123 Fifth St., New Bedford, Mass. . Apr. 24, 1895.

Charles L. Bailey . . . Gen. Supt. Boston Manufg. Co. . . . . .
. . . . . Box 143, Waltham, Mass. . Sept. 27, 1894.
Henry A. Bailey . . . Agt. Chicopee Manufg. Co. . . . . Chicopee Falls, Mass. Oct. 25, 1893.
Edwin H. Baker . . . Bliss, Fabyan & Co., Box 2899 . . . . . .
. . . . . 117 Duane St., New York City, N. Y. Apr. 24, 1878.
Philip S. Baker . . . . Sec. and Treas. Crowders Mountain Cotton Mills . . . .
. . . . . Kings Mt., N. C. . . Oct. 24, 1895.
Edward R. Ballou . . . Supt. Brighton Mills . 540 West 23rd St., New York City . Apr. 25, 1894.
William P. Bancroft . . Vice-Pres. Joseph Bancroft & Sons Co. . . . . .
. . . . . Wilmington, Del. . . Oct. 31, 1883.
Louis B. Barker . . . Agt. United States Cotton Co. . . . Central Falls, R. I. . Apr. 27, 1899.
Lewis E. Barnes . . . Agt. Pemberton Co. & Methuen Co., Methuen, Mass. . . . Oct. 24, 1895.
William A. Barrell . . Agt. Lawrence Duck Co. . . . . Lawrence, Mass. . . Apr. 30, 1884.
Edwin N. Bartlett . . . Supt. Sigourney and Rockdale Mills, North Oxford, Mass. . Apr. 29, 1891.
Daniel Moore Bates, Jr. Asst. Supt. Joseph Bancroft & Sons Co., Wilmington, Del. . . Apr. 28, 1898.
Joseph P. Battles . . . Asst. Mgr. Amer. Drosophore Co., Box 1460 . . . . . .
. . . . . 66 Equitable Building, 150 Devonshire St., Boston, Mass. . . . Oct. 24, 1895.
George W. Bean . . . Agt. Androscoggin Mills . . . . . Lewiston, Me. . . . Apr. 17, 1872.
Robert Beatty . . . . Robert Beatty & Co. . . . . .
. . . . . Coral and Adams Sts., Philadelphia, Pa. . . Oct. 27, 1897.
Truman Beckwith . . . Treas. Dyerville Manufg. Co. . Box 171, Providence, R. I. . Apr. 27, 1892.
John W. Bell . . . . . Asst. Treas. and Mgr. Smith & Dove Manufg. Co. . . . .
. . . . . Andover Mass. . . . Oct. 27, 1897.
A. C. Bent . . . . . Agt. Safety Seamless Pocket Co. . . Taunton, Mass. . . . Oct. 27, 1897.
W. N. Blackstone . . . Treas. Attawaugan Co. . . . . Norwich, Conn. . . . Apr. 29, 1896.
William W. Blades . . Gen. Supt. Lorraine Mfg. Co. . . . . .
. . . . . 135 Mineral Spring Ave., Pawtucket, R. I. . . Oct. 25, 1893.
T. Ashby Blythe . . . Proprietor Ashby Cotton Mills . . . . . .
. . . . . 114 Chestnut St., Philadelphia, Pa. . . Oct. 27, 1897.
John P. Bodge . . . . Treas. Arkwright Mills . . . . . Fall River, Mass. . . Oct. 27, 1897.
Jefferson Borden, Jr. . Supt. Fall River Bleachery . . . . Fall River, Mass. . . Apr. 27, 1899.

Nathaniel B. Borden	Treas. Barnard Manufg. Co.	Fall River, Mass.	Oct. 15, 1873.
Richard B. Borden	Treas. Richard Borden Mfg. Co. Treas. Troy C. & W. Mfg. Co.	Fall River, Mass.	July 18, 1866.
Thomas J. Borden	Pres. Richard Borden Manufg. Co.	Box 118, Fall River, Mass.	Apr. 20, 1865.
E. S. Boss		Willimantic, Conn.	Oct. 29, 1879.
Stephen N. Bourne	Agt. Stark Mills	Manchester, N. H.	Oct. 21, 1869.
Frank A. Bowen	Supt. Appleton Co.	Lowell, Mass.	Apr. 28, 1897.
Arthur F. Brackett	Supt. Royal Arctic & Valley Queen	Riverpoint, R. I.	Oct. 24, 1895.
A. W. Brainerd	Supt. H. N. Slater Mills	Webster, Mass.	Apr. 28, 1898.
Ernest Bridge	Supt. Jas. Chadwick & Bro. Ltd.	Jersey City, N. J.	Apr. 24, 1895.
Christopher P. Brooks	Managing Director New Bedford Textile School	New Bedford, Mass.	Apr. 28, 1897.
Henry R. Brown	Supt. Hope Co. and Phenix Mill	Phenix, R. I.	Apr. 28, 1897.
Isaac A. Brown	Treas. Narragansett Mills	Box 324, Fall River, Mass.	Sept. 29, 1898.
James W. Brown	P. O. Box 312,	Ipswich, Mass.	Oct. 24, 1895.
O. S. Brown	Agt. Salmon Falls Manufg. Co.	Salmon Falls, N. H.	Apr. 21, 1875.
Thomas J. Brown	George Brown's Sons	Mt. Joy, Penn.	Oct. 27, 1897.
E. C. Bucklin	Treas. Interlaken Mills, Treas. Harris Mfg. Co.	Box 289, Providence, R. I.	Apr. 25, 1883.
Robert Burgess	Agt. Grinnell Mfg. Corp.	New Bedford, Mass.	Apr. 27, 1892.
Edward N. Burke	Lowell Machine Shop	Lowell, Mass.	Apr. 28, 1880.
Hervey Burnham	Supt. Beaver Mills and Eclipse Mill	North Adams, Mass.	Apr. 27, 1899.
W. R. Burnham	Treas. Universal Loom Co.	Norwich, Conn.	Apr. 29, 1885.
William D. Cadwell	Agt. Nashua Mfg. Co. & Jackson Co.,	Nashua, N. H.	Apr. 19, 1871.
John P. Campbell	Supt. New York Mills,	New York Mills, Oneida Co., N. Y.,	Sept. 22, 1896.
Byron F. Card	Agt. Howland Mills	New Bedford, Mass.	Apr. 25, 1888.
Arnold B. Chace, Jr.	Agt. Valley Falls Co. Woonsocket Mills	Valley Falls, R. I.	Apr. 24, 1895.
George A. Chace	Treas. Bourne Mills	Fall River, Mass.	Apr. 25, 1877.
Simeon B. Chase	Treas. King Philip Mills	Fall River, Mass.	Apr. 21, 1875.
Clarence N. Childs	Asst. Supt. Hamilton Manufg. Co.	43 Pine St., Lowell, Mass.	Apr. 24, 1895.
Elmer G. Childs	Agt. Boston Duck Co.	Bondsville, Mass.	Oct. 26, 1892.
Jno. H. C. Church	Asst. Treas and Sec. Monument Mills,	Gt. Barrington, Mass.	Apr. 28, 1897.
Alfred Clarke	Mechanical Engineer, 23 Central St.,	Boston, Mass.	Apr. 30, 1879.
Ernest E. Clark	H. N. Slater Mills	Webster, Mass.	Apr. 29, 1896.
Frederick E. Clarke	Pres. Boston & Lowell R. R. Co.	Lawrence, Mass.	Apr. 20, 1865.
George A. Clark	Supt. Manchester Mills	Manchester, N. H.	Oct. 25, 1882.
E. N. Clemence	Treas. Eagle & Phenix Mills and Agt. for Receivers	Columbus, Ga.	Apr. 28, 1897.
W. H. Cloher, Jr.	Treas. Utica Cotton Co.	Capron, Oneida Co., N. Y.	Sept. 22, 1896.
Alonzo A. Coburn	Treas. Atherton Machine Co.	Lowell, Mass.	Apr. 25, 1888.
Josiah G. Coburn		Newton, Mass.	Apr. 20, 1865.

John A. Collins	Supt. American Linen Co.	73 Cottage St., Fall River, Mass.	Oct. 31, 1883.
Frank B. Comins	Vice-Pres. & Gen'l M'g'r. The Aerophor Co.	45 Milk St., Room 44, Boston, Mass.	Oct. 28, 1891.
John J. Connell	Supt. Cohannet Mills	Taunton, Mass.	Apr. 27, 1892.
Frank H. Cotton	Supt. Hope Mills Mfg. Co.	Hope Mills, N. C.	Apr. 27, 1899.
Alphonse S. Covel	Treas. Tremont and Suffolk Mills,	70 Kilby St., Boston, Mass.	Oct. 31, 1877.
William W. Crapo	Pres. Wamsutta Mills	New Bedford, Mass.	Sept. 29, 1898.
P. T. Creed	Agt. Hopewell Mills	Box 356, Taunton, Mass.	Sept. 22, 1896.
John B. Cudlip	Supt. Gibson Cotton Mills	Marysville, N. Bruns.	Apr. 28, 1897.
H. H. Culver	Supt. Elizabeth Poole Mill	Taunton, Mass.	Apr. 28, 1897.
Henry S. Culver	Supt. Westville Cotton Mill	Taunton, Mass.	Apr. 28, 1897.
A. G. Cumnock	Treas. Appleton Co.	Lowell, Mass.	Oct. 28, 1885.
Andrew J. Currier	Mgr. Albion and Valley Falls Co.	Valley Falls, R. I.	Apr. 25, 1888.
T. B. Dallas	Treas. Phœnix Cotton Mills Treas. Dallas Manufg. Co.	Box 8386, Nashville, Tenn.	Oct. 24, 1895.
Philip Dana	Supt. Dana Warp Mills	Westbrook, Me.	Sept. 29, 1898.
Woodbury K. Dana	Treas. Dana Warp Mills	Westbrook, Me.	Apr. 25, 1888.
Albert W. Danforth	Supt. & Engineer Shanghai Cot. Cloth Mills,	Shanghai, China	
		881 Bridge St., Lowell, Mass.	Apr. 27, 1881.
A. Lockwood Danielson	Asst. Treas. Quinebaug Co.,	Box 900, Providence, R. I.	Sept. 27, 1894.
J. DeForest Danielson	Asst. Treas. Lockwood Co. & Lewiston Bleachery & Dye Works	Providence, R. I.	Sept. 27, 1894.
John W. Danielson	Treas. Lockwood Co.	Box 900, Providence, R. I.	Jan. 15, 1868.
B. D. Davol	Pres. Barnard Mfg. Co.	P. O. Box 418, Fall River, Mass.	Apr. 25, 1877.
James C. Deane	Supt. Griswoldville Manufg. Co.	Griswoldville, Mass.	Apr. 25, 1894.
George DeForest	Treas. Utica Steam Cotton Mills	Utica, New York	Oct. 27, 1897.
William P. Dempsey	Agt. Dempsey Bleachery and Dye Works,	Pawtucket, R. I.	Apr. 28, 1886.
Charles W. Dennett	Agt. Johnson Manufg. Co. Agt. Dunbar Mills Co.	North Adams, Mass.	Oct. 29, 1890.
Edward P. Dennis	Lowell Machine Shop	Lowell, Mass.	Apr. 25, 1888.
Charles A. Denny	Pres. American Card Clothing Co.	Leicester, Mass.	Apr. 25, 1888.
P. Y. DeNormandie	Agt. Potomska Mills	New Bedford, Mass.	Apr. 29, 1896.
Charles Owen Dexter	Mgr. Canadian Col'd Cot Mills, Ltd.	Hamilton, Ont., Can.	Apr. 24, 1895.
Lewis Dexter, Jr.	Mgr. The Canadian Colored Cotton Mill Co., Ltd.	Milltown, N. B.	Apr. 27, 1899.
Samuel Dibble	Pres. Enterprise Cotton Mills,	Orangeburg, S. C.	Sept. 29, 1898.
John W. Dickinson	Supt. Lyman Mills	Holyoke, Mass.	Oct. 27, 1897.
F. Dilling	Sec'y & Treas. Dilling Cotton Mills	Kings Mountain, N. C.	Oct. 24, 1895.
Albert W. Dimick	Agt. Indian Head Mills of Alabama,	Cordova, Ala.	Apr. 25, 1894.
Bradford C. Divine	Supt. and Mgr. Utica Willow Vale Bleaching Co.	Chadwicks, N. Y.	Apr. 27, 1899.
Eben S. Draper	Agt. Draper Co.	Hopedale, Mass.	Oct. 31, 1888.
George A. Draper	Treas. Draper Co.	Hopedale, Mass.	Oct. 31, 1888.
George Otis Draper	Sec'y Draper Co.	Hopedale, Mass.	Apr. 24, 1895.

William F. Draper	Pres. Draper Co.	Hopedale, Mass.	July 17, 1867.
William F. Draper, Jr.	Draper Co.	Hopedale, Mass.	Oct. 29, 1890.
John Drowne	Supt. Cocheco Mfg. Co.	Dover, N. H.	Apr. 29, 1896.
Joseph M. Dunham	190 Walnut St.,	Holyoke, Mass.	Oct. 26, 1892.
Frank H. Dwelly	Treas. Tecumseh Mills	Fall River, Mass.	Apr. 27, 1899.
David H. Dyer	D. H. Dyer & Son, Mill Engineers 7 and 8 Pocassett Bank Building,	Fall River, Mass.	Oct. 18, 1871.
William A. Eastman	Treas. Lowell Hosiery Co.	Lowell, Mass.	Apr. 24, 1878.
Russell W. Eaton	Agt. Cabot Manufg. Co.	Brunswick, Me.	Oct. 26, 1887.
John Eccles	Supt. Ponemah Mills	Taftville, Conn.	Apr. 27, 1892.
Lawrence V. Elder	Contractor 212 Tremont St.,	Galveston, Texas	Oct. 27, 1886.
Oscar Elsas	Vice-Pres. Fulton Bag & Cotton Mills, P. O. Box 773,	Atlanta, Ga.	Apr. 28, 1897.
Frederick W. Ely	Agt. Columbian Manufg. Co.	Greenville, N. H.	Apr. 25, 1888.
H. B. Estes	Agt. Continental Mills	Lewiston, Me.	Apr. 26, 1893.
William Evans	Supt. Richard Borden Mfg. Co.	Fall River, Mass.	Apr. 29, 1896.
C. E. Falls	Sec. and Treas. Enterprise Mills	Kings Mountain, N. C.	Oct. 24, 1895.
Herbert R. Farnum	Supt. Bernon Mill	Georgiaville, R. I.	Apr. 27, 1881.
Charles F. Farrar	Supt. Wm. A. Slater Mills Corp.	Slatersville, R. I.	Oct. 27, 1897.
Frank S. Field	Supt. & Agt. Massaemit Yarn Mills	Shattuckville, Mass.	Oct. 24, 1895.
William Firth	Mgr. Am. Drosophore Co. 150 Devonshire St.,	Boston, Mass.	Apr. 25, 1888.
Charles H. Fish	Agt. Cocheco Manufg. Co.	Dover, N. H.	Apr. 27, 1887.
Henry E. Fisher	Vice-Pres. & Agt. Atlanta Cotton Mills	Atlanta, Ga.	Oct. 24, 1895.
Herbert Fisher		Taunton, Mass.	Oct. 29, 1879.
William B. Fittz	Supt. West Boylston Manufg. Co.	Oakdale, Mass.	Oct. 26, 1892.
Frederick A. Flather	Mech. Engineer & Foreman Lowell Machine Shop	Lowell, Mass.	Apr. 29, 1891.
M. F. Foster		Milford, N. H.	Apr. 17, 1872.
Philip H. Fowler		Gloucester City, N. J.	Nov. 30, 1881.
Edward W. France	Dir. of Philadelphia Textile School, 320 South Broad Street,	Philadelphia, Pa.	Sept. 22, 1896.
Arthur C. Freeman	Supt. Finishing Dept., Boston Mfg. Co. 97 Church St.,	Waltham, Mass.	Apr. 27, 1899.
C. H. Frisbie	Agt. Attawaugan Co.	Norwich, Conn.	Oct. 29, 1890.
W. T. Galey	Pres. Aberfoyle Manufg. Co.	Chester, Pa.	Apr. 28, 1897.
William Gammell	Agt. Berkeley Co.	Providence, R. I.	Oct. 28, 1885.
James G. Garland	10 Adams St.	Biddeford, Me.	Oct. 29, 1879.
Edward T. Garsed	Treas. Hucomuga Mills	Greensboro, N. C.	Apr. 28, 1898.
Joshua Garsed	Wingohocking Mills, Frankford	Philadelphia, Pa.	Oct. 27, 1897.

James A. Gary . . . . Alberton Mills . 108 W. German St., Baltimore, Md. . . . Apr. 25, 1883.
James Gee . . . . . Supt. Interlaken Dye Works . . . . Fiskville, R. I. . . . Apr. 28, 1898.
Charles E. Getchell . . Supt. Waltham Bleachery and Dye Works . . . . . P. O. Box 62, 35 Willow St., Waltham, Mass. . . . Oct. 30, 1889.
Daniel Gilligan . . . . Supt. Pocasset and Metacomet Mills, Fall River, Mass. . . Apr. 29, 1896.
William C. Godfrey . . Agt. Indian Orchard Co. . . . . Indian Orchard, Mass. Oct. 29, 1890.
Alfred M. Goodale . . Treas. Boston Manufg. Co. . . . . 50 State St., Boston, Mass. . . . . Apr. 25, 1883.
Charles H. Gorton . . Agt. Glenark Knitting Co. . . . . Woonsocket, R. I. . Apr. 25, 1894.
Marcellus Gould . . . Agt. Falls Company 85 Sachem St., Norwich, Conn. . . . Sept. 22, 1896.
William B. Gowdey . . Mfr. of Reeds, 40 Clifford St. Box 707, Providence, R. I. . . Apr. 30, 1890.
George P. Grant, Jr. . . Treas. Grant Yarn Co. . . . . Fitchburg, Mass. . . Sept. 27, 1894.
D. W. Gray . . . . . Supt. Skenandoa Cotton Co. . . . . Utica, N. Y. . . . . Oct. 26, 1892.
R. A. Gray . . . . . Supt. Rodman Manufg. Co. . . . . Allenton, R. I. . . . Apr. 24, 1895.
Stephen Greene . . . Mill Architect and Engineer . . . . . 131 Devonshire St., Boston, Mass. . . . Oct. 27, 1886.
William C. Greene . . Gen. Mgr. Peace Dale Manufg. Co. . Peace Dale, R. I. . . Oct. 27, 1886.
Joseph Warren Greene . Supt. Hamilton Web Co. . . . . Hamilton, R. I. . . . Apr. 29, 1896.
John Gregson . . . . Supt. Merchants Mfg. Co. . . . . P. O. Box 625, Fall River, Mass. . . Apr 24, 1895.
Maxwell Grierson . . . Gn. Mgr. Jas. Chadwick & Bro., Ltd., Jersey City, N. J. . . Apr. 28, 1898.
Frederick Grinnell . . Pres. Gen. Fire Extinguisher Co. . . New Bedford, Mass. . Apr. 24, 1878.
David Grove . . . . . Supt. Dyerville Manufg. Co. . . . . 610 Manton Ave., Providence, R. I. . . Apr. 28, 1898.
H. S. Grove . . . . . Pres. Argo Mills Co., 218 Race St., Philadelphia, Pa. . . Apr. 28, 1898.
Arthur H. Gulliver . . Asst. Supt. Lonsdale Co. . . . . Ashton, R. I. . . . . Apr. 24, 1889.
B. F. Guy . . . . . Gen. Supt. Pelzer Manufg. Co. . . . Pelzer, S. C. . . . . Apr. 24, 1895.

William J. Hadfield . . Supt. Atlantic Mills 225 Bailey St., Lawrence, Mass. . . Apr. 27, 1899.
Effingham C. Haight . Treas. Wampanoag Mills . . . . . Fall River, Mass. . Apr. 27, 1899.
Frank J. Hale . . . . Agt. Saco and Pettee Machine Shops . . . . . Newton Upper Falls, Mass. . Apr. 27, 1892.
Samuel Hale . . . . . Vice-Pres. and Gen. Manager Dixie . . . . . Cotton Mills . . . . . La Grange, Ga. . . . Apr. 29, 1891.
William E. Hall . . . Treas. Shaw Stocking Co. . . . . Lowell, Mass. . . . Apr. 27, 1892.
Z. D. Hall . . . . . Supt. Berkshire Cotton Mfg. Co. . . . . P. O. Box 963, Adams, Mass. . . . Oct. 29, 1879.
John H. Hambly . . . Treas. Quidnick Manufg. Co. . . . . 49 Westminster St., Providence, R. I. . . Apr. 24, 1895.
A. M. Hamilton . . . Supt. Parker Mills . . . . . Fall River, Mass. . . Apr. 28, 1897.
John F. Hamlet . . . P. O. Box 160 . . . . . Fall River, Mass. . . Oct. 31, 1888.
Joseph O. Hannum . . Agt. Saratoga Victory Manufg. Co. . . . . Victory Mills, Saratoga Co., N. Y. . Apr. 30, 1890.
Henry F. Harris . . . Treas. West Boylston Manufg. Co. . . . . Room 509, State Mutual Building, Worcester, Mass. . . Apr. 30, 1890.

John J. Hart	Charlton Manufg. Co.	Pawtucket, R. I.	Apr. 24, 1895.
William D. Hartshorne	Agt. Arlington Mills	Lawrence, Mass.	Apr. 27, 1899.
Samuel E. Hathaway	Supt. Fall River Iron Works Co.	Fall River, Mass.	Sept. 27, 1894.
William Hathaway	Supt. Barnard Manufg. Co.	Fall River, Mass.	Apr. 25, 1894.
William B. Hawes	Treas. No. Dighton Cotton Co.	Fall River, Mass.	Oct. 24, 1895.
Alfred Hawkesworth	Supt. Merchants Cotton Co.	Montreal, P. Q.	Apr. 26, 1893.
Fred Hawkesworth	Asst. Supt. Merchants Cotton Co.	Montreal, P. Q.	Sept. 22, 1896.
William Hayes	Agt. Barker Mill	Auburn, Me.	Apr. 30, 1879.
W. G. Henderson	Agt. Shetucket Co.	Norwich, Conn.	Apr. 29, 1896.
James G. Hill	Cotton Manufr., Merrimack House	Lowell, Mass.	Jan. 15, 1868.
William R. Hill	Treas. Glasgow Manufg. Co.	South Hadley Falls, Mass.	Oct. 25, 1893.
George H. Hills	Treas. Davol Mills & Stevens Mfg. Co.	Fall River. Mass.	Oct. 24, 1895.
Charles H. Hobbs	Agt. Thorndike Co.	Thorndike, Mass.	Apr. 28, 1886.
Franklin W. Hobbs	Asst. Treas. Arlington Mills	P. O. Box 3590, Boston, Mass.	Apr. 27, 1899.
Louis L. Hohn	Supt. Wm. Clark Thread Co.,	122 High St., Westerly, R. I.	Apr. 28, 1897.
John Holland	12 Trackey St.	P. O. Box 96, Dover, N. H.	Oct. 31, 1877.
Charles M. Holmes	Supt. Manchaug Co.	Manchaug, Mass.	Apr. 27, 1899.
Gideon F. Holmes	Treas. and Gen. Mgr. Plymouth Cor- dage Co.	No. Plymouth, Mass.	Oct. 30, 1889.
George W. Holt	Agt. Monohansett Manufg. Co.	Putnam, Conn.	Oct. 29, 1879.
William P. Holt	Agt. William A. Slater Mills Corp.	Box 315, Slatersville, R. I.	Oct. 25, 1893.
George L. Hooper	7 Belmont St.,	Lowell, Mass.	Apr. 27, 1892.
Jno. Hopkinson	Gen. Mgr. Slayden & Kirksey Woolen Mills	Waco, Texas	Apr. 25, 1883.
Thomas Horsfield	3 Albion St.	Fall River, Mass.	Oct. 27, 1897.
Henry S. Houghton, Jr.	Supt. Paul Whitin Manufg. Co.	Northbridge, Mass.	Apr. 24, 1895.
W. C. Houston, Jr.	Pres. Hope Mills Manufg. Co. 333 Drexel Building,	Philadelphia, Pa.	Apr. 28, 1897.
Elisha H. Howard	Treas. Harris Textile Co. 309 Butler Exchange,	Providence, R. I.	Apr. 25, 1883.
Henry S. Howe	Dry Goods Commission, 68 Chauncy St.,	Boston, Mass.	Oct. 31, 1877.
Albert C. Hoy	Asst. Supt. Hamlet Mills	Woonsocket, R. I.	Apr. 28, 1898.
W. S. Hume	Supt. Dominion Cotton Mills, Ltd. 176 Notre Dame St.,	Hochelaga, P. Q., Can.	Oct. 29, 1890.
Arthur W. Hunking	374 Stevens St.	Lowell, Mass.	Apr. 24, 1895.
D. Edwin Irving	Treas. The Irving & Leiper Mfg. Co.,	Chester, Pa.	Oct. 27, 1897.
J. E. Jenckes	Treas. E. Jenckes Manufg. Co.	Pawtucket, R. I.	Apr. 24, 1895.
Edward B. Jennings	Treas. Globe Yarn Mills	Fall River, Mass.	
David L. Jewell	Agt. China, Webster & Pembroke Mills	Suncook, N. H.	Apr. 20, 1865.
David S. Johnston	Treas. Cohoes Iron Foundry & Mach. Co.,	Cohoes, N. Y.	Oct. 28, 1891.
W. T. Jordan	Mgr. Mountain Island Mfg. Co.	Mountain Island, N. C.	Oct. 24, 1895.

Frank E. Kaley . . . . Treas. Morse & Kaley Mfg. Co. . . Milford, N. H. . . . Oct. 24, 1895.
W. E. Keach . . . . . Supt. Grant Yarn Co. . 123 Myrtle Ave., Fitchburg, Mass. Oct. 26, 1892.
Roland R. Kelly . . . Supt. Williamstown Manufg. Co. . Williamstown Sta., Mass. Nov. 30, 1881.
Joseph H. Kendrick . . Agt. American Supply Co. Box 850, Providence, R. I. . . Apr. 30, 1879.
George E. Kent . . . . Gen. Mgr. Exeter Manufg. Co. . . . Pittsfield, N. H. . . Oct. 31, 1888.
Hervey Kent . . . . . Pres. Exeter Manufg. Co. . . . . Exeter, N. H. . . . Apr. 20, 1865.
Nathaniel B. Kerr . . . Agt. Boott Cotton Mills . . . . . Lowell, Mass. . . . Oct. 26, 1892.
John Kilburn . . . . . Belmont, Mass. . . . Apr. 20, 1865.
Harry W. Kimball . . Supt. Dominion Cotton Mills Co. . . . . .
. . . . . Magog, Province Quebec, Can. . . . . Oct. 24, 1895.
Benjamin B. Kirk . . . Supt. Shove Mills . . . . . .
. . . . . P. O. Box 140, 2107 South Main St., Fall River, Mass. . Apr. 28, 1897.
Albert Knight . . . . Supt. Quidnick Mills . . . . . Quidnick, R. I. . . . Apr. 24, 1895.
Albert F. Knight . . . . . Auburn, R. I. . . . Oct. 27, 1886.
C. Prescott Knight . . Pres. River Point Corp. . . . . River Point, R. I. . . Sept. 29, 1898.
Jesse A. Knight . . . . Sec'y & Supt. Lawton Spinning Co. Providence, R. I. . . Oct. 26, 1892.
Stephen A. Knight . . Pres. Hebron Manufg. Co., Box 1434, Providence, R. I. . . Oct. 21, 1868.
Walter B. Knight . . . Reynolds Manufg. Co. . . . . Davisville, R. I. . . Apr. 24, 1889.
Webster Knight . . . Pres. Natick Mills . . . . . Natick, R. I. . . . . Sept. 29, 1898.

Fred Lacey . . . . . Supt. Montreal Cotton Co. . . . . Valleyfield, P. Q. . . Apr. 24, 1895.
William T. Lang . . . Agt. Brookside Mills . . . . . Knoxville, Tenn. . . Apr. 28, 1897.
Walter H. Langshaw · Agt. Dartmouth Manufg. Corp. . . New Bedford, Mass. . Apr. 29, 1896.
Elliott Cowdin Lambert Supt. Amoskeag Manufg. Co. . . . Manchester, N. H. . Oct. 24, 1895.
George H. Law . . . Supt. Merchants Mfg. Co. . . . . .
. . . . . 815 Walnut St., Fall River, Mass. . . Apr. 28, 1897.
Abbott F. Lawrence . . Treas. Nemasket Mills . . Box 848, Taunton, Mass. . . . Apr. 24, 1895.
Harold Lawton . . . . Gen. Mgr. Warwick Mills . . . . . Centreville, R. I. . . Oct. 27, 1886.
Evan Arthur Leigh . . Textile Machinery . . 70 Kilby St., Boston, Mass. . . . Oct. 29, 1890.
John Leiper . . . . . Supt. Fitchburg Manufg. Co. . . . . .
. . . . . 171 Blossom St., W. Fitchburg, Mass. Oct. 27, 1897.
J. Colby Lewis . . . . Supt. W. A. Slater Mills Corp. . . . Jewett City, Ct. . . . Oct. 26, 1892.
Leontine Lincoln . . . Pres. Seaconnet Mills . . . . . Fall River, Mass. . . Apr. 28, 1897.
B. F. G. Linnell . . . Greene & Daniels Mfg. Co. . . . . .
. . . . . P. O. Box 645, Central Falls, R. I. . Oct. 27, 1897.
Charles Warren Lippitt, Treas. Silver Spring B. & D. Co. . . Providence, R. I. . . Oct. 30, 1878.
Henry F. Lippitt . . . Agt. Social and Manville Cos. . . . Providence, R. I. . . Apr. 27, 1881.
William H. Loftus . . Supt. Clark Thread Co. . . . . Newark, N. J. . . . Oct. 27, 1897.
Robert W. Lord . . . Agt. R. W. Lord & Co. . . . . Kennebunk, Me. . . Oct. 20, 1869.
Ernest Lovering . . . Agt. Lyman Mills . . . . . Holyoke, Mass. . . . Apr. 25, 1888.
Henry M. Lovering . . Agt. Whittenton Manufg. Co. . . . Taunton, Mass. . . . Oct. 27, 1880.
William C. Lovering . Pres. Whittenton Mfg. Co., . . 40 Water St., Boston, Mass. Oct. 25, 1876.
William M. Lovering . Supt. Whittenton Manufg. Co. . . . Taunton, Mass. . . . Sept. 27, 1894.
Arthur H. Lowe . . . Treas. Parkhill Manufg. Co. . . . . Fitchburg, Mass. . . Oct. 30, 1889.
David Lowe . . . . . Asst. Supt. Parkhill Manufg. Co. . . Fitchburg, Mass. . . Apr. 24, 1895.

Dudley T. Lyall	Asst. Mgr. Brighton Mills	541 W. 23d St., N. Y.	Sept. 22, 1896.
William L. Lyall	Supt. J. & W. Lyall Loom and Machine Works	540 W. 23d St., New York City	Oct. 26, 1892.
Herbert Lyman	Treas. Hadley Co.	95 Milk St., Boston, Mass.	Oct. 24, 1895.
Otis G. Lynch	Supt. Enterprise Manufg. Co.	Augusta, Ga.	Oct. 24, 1895.
Alvin S. Lyon	Supt. Lowell Manufg. Co.	Lowell, Mass.	Apr. 26, 1882.
James R. MacColl	Treas. Lorraine Manufg. Co.	Pawtucket, R. I.	Apr. 24, 1895.
Charles L. Macomber	Agt. Nemasket Mills	Taunton, Mass.	Apr. 24, 1895.
Charles T. Main	Mech. and Mill Engineer	Exchange Bldg., Boston, Mass.	Oct. 28, 1885.
Charles R. Makepeace	Mill Engineer	Box 973, Providence, R. I.	Apr. 30, 1890.
A. T. Malcolmson		92 Hunter St., Hamilton, Province Ontario, Can.	Oct. 27, 1897.
Arthur B. Mann	J. H. Martin & Co., Box 465, 99 Franklin St., New York		Apr. 25, 1894.
Charles H. Manning	Supt. Amoskeag Manufg. Co.	Manchester, N. H.	Oct. 28, 1885.
Henry F. Mansfield	Supt. Utica Steam Cotton Mills and Mohawk Valley Cotton Mills	Utica, N. Y.	Apr. 30, 1890.
Paul J. Marrs	Treas. Henderson Cotton Mills	Henderson, Ky.	Oct. 27, 1897.
Albert G. Martin	Supt. Kincaid Manufg. Co.	Box 182, Griffin, Spalding County, Ga.	Apr. 30, 1884.
Henry D. Martin	Supt. Hamilton Woolen Co.	Amesbury, Mass.	Apr. 28, 1897.
Ira J. Martin	Supt. Bozrahville Co., 62 Conant St.,	Pawtucket, R. I.	Oct. 26, 1892.
John R. Mason	Supt. Laurel Lake Mills	439 Middle St., Fall River, Mass.	Apr. 28, 1897.
Philip A. Mathewson	Supt. King Philip Mills	Box 607, Fall River, Mass.	Apr. 24, 1895.
Thomas Mayor	Textile Machinery	Thomas Mayor & Son, 26 Olney St., Providence, R. I.	Oct. 27, 1880.
Robert McArthur	Agt. Pepperell and Laconia Cos.	Biddeford, Me.	Apr. 17, 1872.
Thos. McAuliffe	Supt. Stevens Mfg. Co.	Fall River, Mass.	Apr. 28, 1898.
Charles D. McDuffie	Agt. Manchester Mills	Manchester, N. H.	Apr. 21, 1869.
Fred C. McDuffie	Treas. Everett Mills and York Manufg. Co.	P. O. Box 2963, 40 Water St., Boston, Mass.	Oct. 25, 1882.
William G. McLoon	Supt. Lancaster Mills,	Clinton, Mass.	Apr. 27, 1892.
William P. McMullan	Agt. Naumkeag Steam Cotton Co.	Salem, Mass.	Sept. 27, 1894.
John Tempest Meats	Gen. Supt. Mason Machine Works	Taunton, Mass.	Apr. 27, 1887.
Charles H. Merriman, Jr.	Supt. Globe Mill	Woonsocket, R. I.	Apr. 24, 1895.
Frank M. Messenger	Agt. Grosvenor Dale Co.	No. Grosvenor Dale, Conn.	Apr. 27, 1887.
W. H. Miles	Agt. Farwell Mills	Lisbon, Me.	Sept. 22, 1896.
R. M. Miller, Jr.	Vice Pres. The Atherton Mills	Charlotte, N. C.	Sept. 29, 1898.
James I. Milliken	Agt. Everett Mills	Lawrence, Mass.	Oct. 26, 1892.
Roscoe S. Milliken	Supt. Nashua Mfg. Co.	Nashua, N. H.	Apr. 29, 1896.
David Milne	C. J. Milne & Sons	Washington Ave. & 11th St., Philadelphia, Pa.	Apr. 28, 1897.
A. B. Mole	Mgr. Greylock Mill	Adams, Mass.	Apr. 24, 1895.
Edward A. Mongeon	Supt. Blackstone Manufg. Co.	Blackstone, Mass.	Apr. 24, 1895.
J. R. Montgomery	Pres. The J. R. Montgomery Co.	Windsor Locks, Conn.	Sept. 29, 1898.

George A. Moody	Supt. Warren Cotton Mills	West Warren, Mass.	Apr. 27, 1899.
Fred W. Moore	Agt. Cordis Mills	Millbury, Mass.	Apr. 27, 1892.
Albert H. Morton	Supt. Kitson Machine Co.	Lowell, Mass.	Oct. 28, 1891.
Oliver H. Moulton	Supt. Hamilton Manufg. Co.	Lowell, Mass.	Apr. 20, 1865.
Farquharson J. Muir	Supt. St. Croix Cotton Co.	Milltown, N. B., Can.	Apr. 27, 1892.
Roscius C. Newell	Supt. Palmer Mill	Three Rivers, Mass.	Oct. 24, 1895.
William G. Nichols	Sec. and Treas. Springsteine Mills	Chester, S. C.	Oct. 25, 1893.
Franklin Nourse	Agt. Lawrence Manufg. Co.	Lowell, Mass.	Apr. 24, 1878.
S. Odenheimer	Treas. Lane Mills	New Orleans, La.	Oct. 25, 1893.
Charles K. Oliver	Treas. Columbia Mills Co.	Columbia, S. C.	Sept. 27, 1894.
J. Edward Osborn	Treas. American Linen Co.	Fall River, Mass.	Apr. 28, 1897.
Oscar L. Owen	Mech. and Mill Eng. Whitin Machine Works	Whitinsville, Mass.	Apr. 25, 1894.
Elmer E. Page	Agt. York Manufg. Co.	Saco, Me.	Apr. 27, 1892.
Francis J. Parker	Treas. Monadnock Mills, 27 Kilby St.,	Boston, Mass.	Jan. 15, 1868.
O. B. Parker	Supt. U. S. Cotton Co.	Central Falls, R. I.	Apr. 24, 1895.
Samuel L. Parker	Supt. Turners Falls Cotton Mills	Box 627, Turners Falls, Mass.	Apr. 29, 1896.
Walter E. Parker	Agt. Pacific Mills, 217 Haverhill St.,	Lawrence, Mass.	Apr. 25, 1877.
John H. Parks	Pres. Wm. Parks & Son, Ltd.	St. John, N. B.	Apr. 24, 1878.
Duncan D. Parmly	Treas. Johnson Mfg. Co. and Dunbar Mills Co.	49 Wall St., New York, N. Y.	Sept. 22, 1896.
John W. Pead	Agt. Merrimack Manufg. Co.	Box 1231, Lowell, Mass.	Apr. 26, 1893.
James R. Pearce	Supt. Camden Cotton Mills	Camden, S. C.	Oct. 24, 1895.
William C. Peirce	Pres. Elizabeth Mills, 564 Eddy St.,	Providence, R. I.	Apr. 24, 1895.
William D. Pennell	Agt. Hill Manufg. Co.	Lewiston, Me.	Apr. 16, 1873.
Haven C. Perham	Treas. Kitson Machine Co.	Lowell, Mass.	Apr. 30, 1879.
Henry C. Phillips	New York Mills	Oneida Co., New York, N. Y.	Apr. 25, 1894.
Benjamin Phipps	Treas. Clarendon Mills	4 Winthrop Sq. Boston, Mass.	Sept. 29, 1898
Andrew G. Pierce, Jr.	Treas. Rotch Spinning Co. Treas. Pierce Manufg. Corp. Treas. Howland Mills Corp.	P. O. Box, 34, New Bedford, Mass.	Apr. 24, 1895.
Moses Pierce	Pres. Aspinook Co.	274 Broadway, Norwich, Conn.	Oct. 30, 1878.
Reuben Pilling, Jr.	Supt. Granite Mills Co.	30 Hudson St., Providence, R. I.	Apr. 29, 1896.
Charles H. Plummer	Agt. Great Falls Manufg. Co.	Somersworth, N. H.	Apr. 25, 1888.
Charles T. Plunkett	Sec. Berkshire Cotton Mfg. Co.	Adams, Mass.	Apr. 28, 1897.
Joseph H. Potter, Jr.	Supt. Durfee Mills	Fall River, Mass.	Apr. 27, 1899.
Herbert L. Pratt	Agt. Bates Manufg. Co.	Lewiston, Me.	Oct. 27, 1875.
T. W. Pratt	Pres. West Huntsville Cotton Mill Co.	Huntsville, Ala.	Sept. 22, 1896.
John E. Prest	Gen. Supt. Harmony Mills	Cohoes, N. Y.	Apr. 17, 1872.

M. W. Quinn	Agt. Hamilton Woolen Co.	Amesbury, Mass.	Oct. 27, 1886.
T. G. Ramsdell	Agt. Monument Mills	Housatonic, Mass.	Oct. 30, 1878.
Emory S. Rathburn	Supt. Pequot Mills	Montville, Conn.	Apr. 27, 1899.
M. A. Rawlinson	Supt. Tremont and Suffolk Mills	Lowell, Mass.	Apr. 24, 1895.
Robert Redford		Lawrence, Mass.	Apr. 26, 1882.
R. S. Reinhardt	Treas. and Mgr. Elm Grove Cotton Mills	Lincolnton, N. C.	Apr. 28, 1898.
James Renfrew	Treas. Renfrew Manufg. Co.	Adams, Mass.	Oct. 18, 1871.
Roscoe C. Reynolds	Agt. and Treas. Lewiston Machine Co.	Lewiston, Me.	Oct. 25, 1876.
F. H. Rice	394 Pleasant St.,	Worcester, Mass.	Apr. 28, 1880.
Charles H. Richardson	Agt. Lancaster Mills	Clinton, Mass.	Apr. 24, 1889.
W. H. Richmond	Supt. Bibb Mill No. 2	Macon, Ga.	Oct. 27, 1897.
C. W. Rider	Treas. Merrick Thread Co.	Holyoke, Mass.	Apr. 29, 1896.
Charles E. Riley	Textile Machinery	Box 2815	
		281 Congress St., Boston, Mass.	Apr. 25, 1888.
George W. Robbins	Supt. Barry Cotton Mill	Smithville, Barre, Mass.	Apr. 28, 1897.
Charles D. Robinson	Supt. Crompton Co.	Crompton, R. I.	Sept. 27, 1894.
William A. Robinson	Asst. Supt. Social Manufg. Co.	Woonsocket, R. I.	Apr. 29, 1896.
John R. Rostron	Supt. Indian Head Mills of Alabama,	Cordova, Ala.	Sept. 29, 1898.
John K. Russell	Gen. Mgr. May's Landing Water P. Co. and Millville Manufg. Co.	Millville, N. J.	Apr. 29, 1891.
Arnold B. Sanford	Manufrs. Agent American Cotton Yarn Exchange	45 Milk St., Boston, Mass.	Oct. 25, 1882.
Charles Henry Savage	Supt. Manville Co.	Manville, R. I.	Apr. 26, 1893.
Henry B. Sawyer	Asst. Treas. Newmarket Mfg. Co.		
		45 Milk St., Boston, Mass.	Oct. 27, 1897.
J. Herbert Sawyer	Treas. Newmarket Manufg. Co.		
		Box 2966, 45 Milk St., Boston, Mass.	July 19, 1865.
F. C. Sayles	Pres. Ponemah Mills	Pawtucket, R. I.	Oct. 27, 1897.
George H. Sayward	Mgr. Standard Yarn Co.	Oswego, N. Y.	Oct. 29, 1890.
Arnold Schaer	Supt. Warren Manufg. Co.	Warren, R. I.	Apr. 24, 1895.
John Scott		Willimantic, Conn.	Oct. 29, 1879.
Charles M. Sears	Agt. Atlantic Cotton Mills	Lawrence, Mass.	Apr. 28, 1898.
George H. Shapley	Mgr. Silver Lake Co., 78 Chauncy St.,	Boston, Mass.	Apr. 29, 1896.
Frank P. Sheldon	Mill Engineer, Industrial Trust Bldg.	Providence, R. I.	Apr. 25, 1894.
Thomas C. Sheldon	Agt. Fitchburg Duck Mills	Fitchburg, Mass.	Oct. 29, 1884.
Willis S. Shepard	Pres. American Net and Twine Co.		
		93 Commercial St., Boston, Mass.	Apr. 29, 1896.
William F. Sherman	Civil Engineer		
		106 New Brazer Bldg., 27 State St., Boston, Mass.	Apr. 15, 1874.
Charles M. Shove	Treas. Granite Mills	Box 45, Fall River, Mass.	Oct. 27, 1875.
Herbert H. Shumway	Treas. Corr Manufg. Co.	Taunton, Mass.	Apr. 26, 1893.
Francis H. Silsbee	Supt. Cotton Dept. Pacific Mills	Lawrence, Mass.	Apr. 27, 1887.
N. G. Simonds	Treas. Naumkeag Steam Cotton Co.,	Salem, Mass.	Apr. 28, 1898.

Louis Simpson	Gen. Mgr. Montreal Cotton Co.	Valleyfield, P. Q.	Apr. 24, 1895.
Abbott E. Slade	Treas. Laurel Lake Mills	Fall River, Mass.	Oct. 25, 1893.
Arba C. Slater	Supt. Linwood Mills	Linwood, Mass.	Jan. 15, 1868.
Arthur T. Smith	Supt. Langley Manufg Co. Supt. Aiken Manufg. Co.	Langley, S. C.	Oct. 24, 1895.
Joel Smith	Supt. The J. P. King Manufg. Co.	Augusta, Ga.	Oct. 24, 1895.
J. C. Smith	Supt. Chace Mills	Fall River, Mass.	Oct. 27, 1897.
James Herbert Smith	Supt. Quinebaug Co.	Danielson, Conn.	Apr. 28, 1898.
Robert R. Smith	Mgr. Greenwoods Co.	New Hartford, Conn.	Oct. 19, 1870.
Ellison A. Smyth	Pres. Pelzer Manufg. Co.	Pelzer, S. C.	Oct. 26, 1892.
William S. Southworth	Agt. Mass. Cotton Mills	Box 1230, Lowell, Mass.	Oct. 31, 1888.
S. S. Spencer	Supt. Conestogo Steam Mills	Lancaster, Pa.	Oct. 25, 1876.
Wilton H. Spencer	Textile Manuf.,	7 Exchange Pl., Providence, R. I.	Apr. 28, 1898.
George E. Spofford	Supt. Readville Cotton Mills	Readville, Mass.	Apr. 29, 1896.
Leroy Springs	Pres. Lancaster Cotton Mills	Lancaster, S. C.	Oct. 24, 1895.
George R. Stearns	Pres. Riverside Mills	Augusta, Ga.	Apr. 30, 1890.
Robert Stewart	Supt. Shove Mills	Fall River, Mass.	Apr. 27, 1899.
Walter F. Stiles	Treas. Orswell Mills	Fitchburg, Mass.	Oct. 24, 1895.
O. W. Stites		Hoosick Falls, N. Y.	Oct. 24, 1895.
Herman F. Straw	Agt. Amoskeag Manufg. Co.	Manchester, N. H.	Oct. 28, 1885.
John Sullivan	Supt. Union Cotton Mills	Fall River, Mass.	Apr. 27, 1899.
Timothy Sullivan	Supt. Davol Mills	Fall River, Mass.	Apr. 27, 1899.
Walter H. Summersby	Supt. Pontiac Mill and Bleachery	Pontiac, R. I.	Oct. 25, 1893.
Albert A. Sweet	Supt. No. Dighton Cotton Co.	36 Rockland St., Fall River, Mass.	Apr. 26, 1893.
James O. Sweet	Agt. and Treas. Ashland Cotton Co.	Jewett City, Conn.	Apr. 28, 1886.

Edward P. Taft	Treas. Ponemah Mills	Box 1443, Providence, R. I.	Oct. 28, 1885.
Robert Rennie Taft	Supt. Baltic Power Co.	Baltic, Conn.	Apr. 24, 1895.
Robert W. Taft	Treas. Coventry Co.	Box 1144, Providence, R. I.	Sept. 27, 1894.
George P. Taylor		Clinton, Mass.	Oct. 27, 1880.
James W. Taylor	Supt. Canoe River Mills	Box 46, Taunton, Mass.	Oct. 26, 1892.
W. Marshall Taylor	Supt. Merrick Thread Co.	Holyoke, Mass.	Sept. 22, 1896.
Richard Thackeray	Supt. Weetamoe Mills	Fall River, Mass.	Apr. 29, 1885.
Earl A. Thissell	Gen. Mgr. Woonsocket Bobbin Co.	Woonsocket, R. I.	Oct. 30, 1878.
Ariel C. Thomas	Supt. Clinton Manufg. Co.	93 Clinton St., Woonsocket, R. I	Oct. 31, 1888.
Charles E. Thomas	Treas. Forestdale Manufg. Co.	44 Prospect St., Woonsocket, R. I.	Oct. 31, 1883.
Edward W. Thomas	Agt. Tremont and Suffolk Mills	Lowell, Mass.	Apr. 30, 1884.
Ralph E. Thomson	Supt. Parkhill Manufg. Co.	Fitchburg, Mass.	Apr. 25, 1894.
D. M. Thompson	Pres. & Treas. Corliss Steam Engine Co.	Providence, R. I.	Oct. 28, 1885.
Joseph S. Tidd	Treas. and Agt. Oakland Mills	Taunton, Mass.	Apr. 27, 1899.
Horace W. Tinkham	Treas. and Agt. Robeson Mills	Fall River, Mass.	Apr. 27, 1899.

James P. Tolman	Pres. Samson Cordage Works	115 Congress St., Boston, Mass.	Oct. 29, 1890.
D. A. Tompkins	Pres. The Atherton Mills	Charlotte, N. C.	Oct. 24, 1895.
George W. Towne	Supt. Cotton Dept. Arlington Mills	Lawrence, Mass.	Oct. 26, 1892.
William E. Trainer	Pres. D. Trainer & Sons Mfg. Co.	Trainer, Penn.	Apr. 21, 1875.
Robert B. Treat	Centerville Cotton Mills	Centerville, R. I.	Sept. 27, 1894.
C. H. Truesdell	Supt. Attawaugan Co.	Killingly, Conn.	Oct. 29, 1884.
Edmund E. Truesdell	Supt. China, Webster & Pembroke Mills	Suncook, N. H.	Apr. 26, 1876.
Oscar B. Truesdell	Agt. Fiskdale Mills	Fiskdale, Mass.	Oct. 15, 1873.
George F. Tryon	Supt. Conanicut Mills, 199 Purchase St.,	Fall River, Mass.	Apr. 28, 1897.
George E. Tucker	Agt. Otis Co.	Ware, Mass.	Oct. 24, 1895.
Charles D. Turnbull	Treas. Wm. A. Slater Mills Corp.	The Ludlow, Boston Mass.	Oct. 27, 1897.
William D. Twiss	Supt. Everett Mills	Lawrence, Mass.	April 29, 1896.
Charles T. Upton	Supt. Shaw Stocking Co.	Lowell, Mass.	Apr. 28, 1897.
George A. Vaughan	Supt. The Putnam Manufg. Co.	Putnam, Conn.	Sept. 22, 1896.
William P. Vaughan	Agt. Putnam Manufacturing Co.	Banigan Building, Providence, R. I.	Sept. 29, 1898.
Frank P. Vogl	Agt. Monadnock Mills	Claremont, N. H.	Sept. 27, 1894.
Jude C. Wadleigh	Supt. Mass. Cotton Mills	Lowell, Mass.	Oct. 26, 1892.
Herbert E. Walmsley	Agt. Wamsutta Mills	New Bedford, Mass.	Oct. 29, 1890.
Robinson Walmsley	Supt. Tecumseh Mills	Fall River, Mass.	Apr. 27, 1899.
Frederick T. Walsh	Agt. Lowell Bleachery & Dye Works,	Lowell, Mass.	Apr. 28, 1897.
James A. Walsh	Agt. Lewiston Bleachery and Dye Works	Lewiston, Me.	Apr. 27, 1892.
John Waterman	Treas. Warren Manufg. Co.	Warren, R. I.	Apr. 30, 1884.
Joseph W. Wattles	Manufacturers' Supplies	Canton Junction, Mass.	July 18, 1866.
George W. Weeks		Clinton, Mass.	Apr. 21, 1869.
W. B. Smith Whaley	Mechanical & Mill Engineer Pres. Richland Cotton Mills Granby Cotton Mills,	1328 Main St., Columbia, S. C.	Apr. 24, 1895.
H. D. Wheat	Pres. and Treas. Gaffney Mfg. Co.	Gaffney, S. C.	Apr. 24, 1895.
Channing Whitaker	Infringement and Patentability of Inventions Lowell Machine Shop	Lowell, Mass.	Oct. 15, 1873.
A. Tenny White	Supt. Manville Co.	Manville, R. I.	Oct. 26, 1887.
Charles D. White	Agt. Uncasville Mfg. Co.	Uncasville, Conn.	Oct. 27, 1897.
Z. L. White	White Brothers	Winchendon, Mass.	Apr. 28, 1897.
Arthur F. Whitin	Pres. Saunders Cotton Mills	Whitinsville, Mass.	Apr. 24, 1895.
Fred B. Whitin	Agt. Uxbridge Cotton Mills	Linwood Mass.	Apr. 28, 1897.
Henry T. Whitin	Treas Paul Whitin Manufg. Co.	Northbridge, Mass.	Apr. 25, 1877.
Alfred N. Whiting	Treas. L. M. Harris Manufg. Co.	Oakdale, Mass.	Apr. 21, 1875.

William S. Whitney	Supt. Mech. Depts., Washington Mills Co.,	Lawrence, Mass.	Apr. 24, 1878.
Arthur Whittam	Sec. and Supt. The Enterprise Cotton Mills,	Orangeburg, S. C.	Apr. 28, 1898.
William Whittam, Jr.	52 Samuel Ave.,	Pawtucket, R. I.	Apr. 26, 1893.
George F. Whitten	Agt. Amory Mfg. Co.	Manchester, N. H.	Oct. 26, 1892.
John H. Whitten	Supt. Stark Mills	Manchester, N. H.	Apr. 28, 1898.
Edward B. Wilbur	Supt. Newberry Cotton Mills	Newberry, S. C.	Oct. 30, 1889.
J. S. Wilbur	Supt. Glasgow Yarn Mills Co.	Glasgow, Conn.	Apr 27, 1899.
Henry M. Wilcox	Treas. John Rhodes Warp Co.	Millbury, Mass.	Apr. 24, 1889.
Eben C. Willey	Agt. Atlantic Mills	Lawrence, Mass.	Apr. 29, 1896.
Theop. W. Wilmarth	Gen. Supt. Galveston City Cotton Mills,	Galveston, Texas	Oct. 31, 1883.
Thomas Wilmarth	Supt. Saunders Cotton Mills	Saundersville, Mass.	Apr. 21, 1875.
J. P. Wilson	Treas. Dover Yarn Mills	Charlotte, N. C.	Oct. 24, 1895.
George Wood	Pres. and Treas. Millville Manufg. Co. 626 Chestnut St.,	Phila., Pa.	Oct. 16, 1872.
John P. Wood	William Wood & Co. Spring Garden and 22d St.,	Philadelphia, Pa.	Apr. 28, 1897.
C. J. H. Woodbury	Secretary and Treasurer	Lynn, Mass.	Oct. 29, 1879.
Adelbert R. Young	Supt. Ashland Cotton Co.	Jewett City, Conn.	Apr. 25, 1894.
James M. Young	Mgr. Hamilton Cotton Co.	Hamilton, Ont., Can.	Apr. 27, 1899.

ASSOCIATE MEMBERS.

Henry Ashworth	Agt. Card Clothing Manufg. Co.	Fall River, Mass.	Apr. 28, 1897.
George R. Babbitt	Pres. American Oil Co. 182 So. Water St.,	Providence, R. I.	Apr. 24, 1895.
D. C. Ball	The American Cotton Co. 27 William St.,	New York, N. Y.	Oct. 24, 1895.
George S. Barnum	Treas. The Bigelow Co.	New Haven, Conn.	Apr. 24, 1895.
Colin C. Bell	Pres. and Treas. Laminar Fibre Co.	No. Cambridge, Mass.	Apr. 29, 1896.
Frank P. Bennett	Publisher American Wool and Cotton Reporter 148 Pearl St.,	Boston, Mass.	Sept. 22, 1896.
A. M. Benson	Mfr. of Cloth Boards 27 Kilby St.,	Boston, Mass.	Apr. 27, 1899.
William H. Bent	Treas. Mason Machine Works	Taunton, Mass.	April 29, 1896.
J. Payson Bradley	The Kehew Bradley Co. 24 Purchase St.,	Boston, Mass.	Apr. 24, 1895.
J. Frank Braids	Mgr. Grease & Oil Dept., Charles S. Bush Co. 212 Weybosset St.,	Providence, R. I.	Apr. 28, 1897.
Henry G. Brinckerhoff	N. E. Mgr. Fuel Economizer Co., Box 2654 Room 1053, Exchange Bldg., 53 State St.,	Boston, Mass.	Sept. 22, 1896.
D. Russell Brown	Pres. Brown Bros. Co.	Providence, R. I.	Apr. 24, 1895.
H. Martin Brown	Brown Bros. Co.	Providence, R. I.	Apr. 24, 1895.

John H. Burghardt	Page Belting Co.	31 Pearl St., Boston, Mass.	Apr. 24, 1895.
Eugene E. Burnham	Belt Mfr.	252 Lowell St., Lawrence, Mass.	Oct. 24, 1895.
Fred N. Bushnell	Mech. Supt. Narragansett Electric Light Co.	Providence, R. I.	Sept. 29, 1898.
Harry W. Butterworth	Sec. H. W. Butterworth & Sons	2417 East York St., Philadelphia, Pa.	Oct. 27, 1897.
James Butterworth	Pres. H. W. Butterworth & Sons Co.	York and Cedar Sts., Philadelphia, Pa.	Apr. 24, 1895.
French Campbell	Commission Merchant	Manchester, N. H.	Oct. 27, 1897.
Malcolm Campbell	Gen. Mgr. Woonsocket Machine and Press Co.	Woonsocket, R. I.	Apr. 24, 1895.
W. W. Carey	Machinery and Pulley Manufacturer,	Lowell, Mass.	Apr. 24, 1895.
Charles H. Child	Treas. Brown Bros. Co.	Box 890, Providence, R. I.	Apr. 24, 1895.
Henry C. Clark	Treas. Standard Mill Supply Co.,	Box 714, Providence, R. I.	Apr. 28, 1898.
Peter H. Corr	Cotton and Cotton Yarns and Waste	38 Court St., Taunton, Mass.	Apr. 24, 1895.
Thomas G. Cox	Selling Agt. Mason Machine Works	Box 316, Taunton, Mass.	Apr. 24, 1895.
George Crompton	Treas. Crompton & Knowles Loom Works	Worcester, Mass.	Oct. 27, 1897.
Randolph Crompton	Vice-Pres. and Asst. Supt. Crompton & Knowles Loom Works	Worcester, Mass.	Oct. 27, 1897.
C. F. Curwen	Treas. Dinsmore Mfg. Co.	Salem, Mass.	Apr. 27, 1899.
Frederick I. Dana	Manager. Thomas Phillips Co.	Providence, R. I.	Apr. 24, 1895.
R. H. Deming	Cotton Broker	10 So. Water St., Providence, R. I.	Apr. 24, 1895.
C. E. W. Dow		67 Burtt St., Lowell, Mass.	Apr. 24. 1895.
Frederick A. Downes	Sec. Factory Mutual Fire Insurance Cos.	925 Chestnut St., Philadelphia, Pa.	Oct. 27, 1897.
G. B. Emmons	Pres. Emmons Loom Harness Co.	Box 94, Methuen Mass.	Oct. 24, 1895.
T. C. Entwistle	Cotton Machinery Builder	323 Market St., Lowell, Mass.	Apr. 24, 1895.
D. D. Felton	Treas. S. A. Felton & Son Co.	Manchester, N. H.	Apr. 24, 1895.
John W. Ferguson	Postal Telegraph Bldg., N. Y., and Paterson, N. J.		Apr. 24, 1895.
Redington Fiske	Gen. Mgr. Planters Compress Co.	89 State St., Boston, Mass.	Apr. 27, 1899.
J. Herbert Foster	Cotton Broker	10 South Water St., Providence, R. I.	Apr. 24, 1895.
Merrill A. Furbush	Pres. M. A. Furbush & Son Machine Co.	224 Market St., Philadelphia, Pa.	Oct. 27, 1897.
John T. Fyans	Agt. Fyans, Frazer & Blackway	411 Beach St., Fall River, Mass.	Apr. 28, 1897.

H. P. Garland . . . . Treas. Loom Picker Co. . . . . Biddeford, Me. . . . Oct. 24, 1895.
Royal W. Gates . . . . Josiah Gates & Sons, Belting . . . . . .
. . . . . 307 Market St., Lowell, Mass. . . . Apr. 24, 1895.
Rufus B. Goff . . . . Pres. Standard Mill Supply Co. . . . . .
. . . . . 77 Exchange Pl., Box 714, Providence, R. I. . . Apr. 28, 1897.
William S. Granger . . Prest. Granger Foundry & Machine Co., Providence, R. I. . Apr. 24, 1895.
Henry T. Grant, Jr. . . Pres. Mercantile Mutual Fire Ins. Co. . . . . .
. . . . . 723 Banigan Building, Providence, R. I. . . Oct. 27, 1897.

A. Walter Harris . . . Treas. A. W. Harris Oil Co. . . . . .
. . . . . 326 So. Water St., Providence, R. I. . . Oct. 24, 1895.
F. A. W. Harris, . . . Harris-Corliss Steam Engine Co., . Providence, R. I. . . Apr. 27, 1899.
Alfred H. Hartley . . Dealer in Oils and Mill Supplies . . . . . .
. . . . . Box 409, Fall River, Mass. . . Oct. 27, 1897.
Jerome Hill . . . . . Pres. Tennessee Planters' Co. . . . . .
. . . . . 334 Front St., Memphis, Tenn. . . . Apr. 29, 1896.
John Hogg . . . . . Smith, Hogg & Gardiner, 140 Essex St., Boston, Mass. . . . Apr. 27, 1899.
Henry A. Holcomb . . . . . Box 249, New Bedford, Mass. . Oct. 24, 1895.
Henry S. Houghton, Sr., Mfr. Grids and Beaters . . . . . .
. . . . . 61 Pond St., Woonsocket, R. I. . Apr. 28, 1897.
C. H. Hutchins . . . . Pres. Crompton & Knowles Loom Works . . . . . .
. . . . . Worcester, Mass. . . Oct. 24, 1895.
W. L. Hutchins . . . Asst. Mgr. Crompton & Knowles Loom Works . . . . .
. . . . . Providence, R. I. . . Apr. 28, 1898.

David Jackson . . . { Pres. and Mgr. Jackson Pat. Shell Roll Co. . . . . } Pawtucket, R. I. . . Apr. 24, 1895.

James H. Kendall . . Edward Kendall & Sons . . . . . Cambridgeport, Mass., Sept. 29, 1898.
William B. Kehew . . The Kehew-Bradley Co. . 24 Purchase St., Boston, Mass. . Apr. 24, 1895.

W. C. Langford . . . Oil Dealer, . . . 86 Weybosset St., Providence, R. I. . . Apr. 27, 1899.
Josiah M. Lasell . . . Asst. Treas. Whitin Machine Works, Whitinsville, Mass. . Apr. 24, 1895.
John H. Lorimer . . . Builder of Textile Machines . . . . . .
. . . . . Ontario and Lawrence Sts., Philadelphia, Pa. . . Oct. 27, 1897.
Stephen C. Lowe . . . Mill Supplies . . . . 87 Union St., New Bedford, Mass. . Oct. 24, 1895.
George A. Lowry . . . Consulting Eng. Planters' Comp. Co., ...
. . . . . 89 State St., Boston, Mass. . . . Apr. 28, 1898.

F. H. Maynard . . . . Bus. Mgr. Gen. Fire Extinguisher Co., Providence, R. I. . . Apr. 24, 1895.
H. G. McKerrow . . . Textile Machinery . . 31 State St., Boston, Mass. . . . Sept. 22, 1896.
George H. Meader . . Steam Appliances . . 35 Oliver St., Boston, Mass. . . . Apr. 24, 1895.
George B. Morison . . Selling Agt. Hadley Co. 95 Milk St., Boston, Mass. . . . Apr. 24, 1895.

George C. Newell . . . Starkweather & Shepley . . . . . .
. . . . . 17 Custom House St., Providence, R. I. . . Sept. 29, 1898.
William R. Noone . . Mfr. Roller and Slasher Cloth . . . . . .
. . . . . 100 Pearl St., Boston, Mass. . . . Oct. 27, 1897.

Sidney B. Paine . . . General Electric Co., 200 Summer St., Boston, Mass. . . . Apr. 24, 1895.
Arthur Parkinson . . . Selling Agt. Arabol Mfg. Co., 13 Gold St., New York, N. Y. Apr. 28, 1897.
Stephen Minot Pitman . Sec'y Narragansett Mutual Fire Insurance Co. . . . . .
. . . . . Box 315, Providence, R. I. . . Apr. 24, 1895.
Vladimir P. Polevoy . { Agent Great Yaroslavskaia Cotton Mill (of Yaroslave), Russia . . . } 120 Broadway, N. Y. Apr. 28, 1897.
Charles A. M. Praray . Chas. A. M. Praray & Co., Mill Architect and Engineer . .
. . . . . Banigan Building, Providence, R. I. . . Apr. 28, 1897.

Charles F. Randall . . Expert in Textiles . . . . . .
. . . . . Room 350, Tremont Building, Boston, Mass. . . . Apr. 24, 1895.
Richard H. Rice . . { Treas. Providence Steam Engine Co. & Rice & Sargent Steam Engine Co. } 521 So. Main St. Providence, R. I. . Apr. 24, 1895
C. E. Roberts . . . . Mgr. Hartford Steam Boiler Insurance & Inspection Co. .
. . . . . 125 Milk St., Boston, Mass. . Apr. 24, 1895.
Louis E. Robinson . . Sea Island Cotton . . . . . .
. . . . . Box 1216, 20 Market Square, Providence, R. I. . . Oct. 27, 1897.
John M. Russell . . . Asst. Treas. Crompton & Knowles Loom Works . . . . .
. . . . . Worcester, Mass. . . Oct. 24, 1895.

H. T. Schaefer . . . . Sterling Coal Co. . . . 5 Custom House St., Boston, Mass., Sept. 29, 1898.
E. A. Smith . . . . . Pres. Charlotte Supply Co. . . . . Charlotte, N. C. . . . Oct. 24, 1895.
Harry M. Smith . . . Vice-Pres. Standard Mill Supply Co. . . . . .
. . . . . 77 Exchange Pl., Box 714, Providence, R. I. . . Apr. 28, 1897.
R. Paul Snelling . . . Treas. Saco and Pettee Machine Shops . . . . . .
. . . . . Newton Upper Falls, Mass. . Sept. 22, 1896.
Lewis R. Speare . . . Alden Speare Sons & Co., Oil and Mill Supplies . . . . .
. . . . . 369 Atlantic Ave., Boston, Mass. . . . . Oct. 24, 1895.
Henry C. Spence . . . Gen. Mgr. Metallic Drawing Roll Co. Indian Orchard, Mass. Apr. 24, 1895.
George W. Stafford . . Mgr. Crompton & Knowles Loom Works . . . . . .
. . . . . Providence, R. I. . . Apr. 24, 1895.
James Strang . . . . Selling Agt. Metallic Drawing Roll Co. . . . . .
. . . . . 123 Hampden St., Indian Orchard, Mass. Oct. 27, 1897.
William H. Stratton . . Mgr. Factory Insurance Association . . . . . .
. . . . . 95 Pearl St., Hartford, Conn. . . Apr. 28, 1897.
Daniel J. Sully . . . . Cotton Broker, T. M. Reynolds & Co., Providence, R. I. . . Apr. 24, 1895.

Cyrus A. Taft . . . . Agt. Whitin Machine Works . . . Whitinsville, Mass. . Apr. 24, 1895.
Charles F. Taylor . . . Owner & Mgr. Burgess Cop Tube Co., ...
. . . . . 48 Custom House St., Providence, R. I. . . Apr. 28, 1898.
Winthrop Thayer . . . Pres. Thayer & Co., Incorp. . . . . .
. . . . . 1015 Tremont Bldg., Boston, Mass. . . . Apr. 29, 1896.
A. Curtis Tingley . . . Treas. National Ring Traveler Co. . . . . .
. . . . . 7 Eddy St., Providence, R. I. . . Sept. 22, 1896.
William V. Threlfall . . Selling Agt. Saco and Pettee Machine Shops . . . . . .
. . . . . Biddeford, Me. . . . Apr. 24, 1895.

Frank H. Underwood . Resident Mgr. Dodge Mfg. Co. . . . . .
. . . . . 137 Purchase St., Boston, Mass. . . . Apr. 29, 1896.

Justin A. Ware . . . . Sales Mgr. Crompton & Knowles Loom Works . . . . .
. . . . . Worcester, Mass. . . Oct. 24, 1895.
Arthur J. Warren . . . Star Harness Co. . . . . Fall River, Mass. . . Apr. 27, 1899.
Walter S. Watson . . . Haworth & Watson, Mfrs. Paper Tubes . . . . . .
. . . . . for Textile Manufg. . Box 996, Lowell, Mass. . . . Oct. 24, 1895.
Stephen M. Weld, . . Cotton Buyer . . . . . 89 State St., Boston, Mass. . . . Apr. 27, 1899.
William R. West . . . Roll Coverer . . 830 Purchase St., New Bedford, Mass. . Sept. 22, 1896.
W. W. White . . . . Agent Holyoke Machine Co. . . . Worcester, Mass. . . Apr. 27, 1899.
G. Marston Whitin . . Treas. Whitin Machine Works . . . Whitinsville, Mass. . Apr. 24, 1895.
Fred A. Wilde . . . . Asst. Treas. The A. T. Atherton Machine Co. . . . . .
. . . . . Pawtucket, R. I. . . Apr. 28, 1897.
Erving Yale Woolley . Stoddard, Haserick, Richards & Co. . . . . .
. . . . . 152 Congress St., Boston, Mass. . . . . Apr. 24, 1895.

Honorary Members	4
Active Members	457
Associate Members	103
Total Membership	564

MEMBERS OF THE ASSOCIATION,

May 1, 1899.

ARRANGED BY STATES.

MAINE.

Auburn	William Hayes	Barker Mill.
Biddeford	James G. Garland	10 Adams St.
Biddeford	H. P. Garland	Loom Picker Co.
Biddeford	Robert McArthur	Pepperell & Laconia Cos.
Biddeford	William V. Threlfall	Saco & Pettee Machine Shop.
Brunswick	Russell W. Eaton	Cabot Manufg. Co.
Kennebunk	Robert W. Lord	R. W. Lord & Co.
Lewiston	George W. Bean	Androscoggin Mills.
Lewiston	H. B. Estes	Continental Mills.
Lewiston	William D. Pennell	Hill Manufg. Co.
Lewiston	Herbert L. Pratt	Bates Manufg. Co.
Lewiston	Roscoe C. Reynolds	Lewiston Machine Co.
Lewiston	James A. Walsh	Lewiston Bleachery and Dye Works.
Lisbon	W. H. Miles	Farwell Mills.
Saco	Elmer E. Page	York Manufg. Co.
Westbrook	Philip Dana	Dana Warp Mills.
Westbrook	Woodbury K. Dana	Dana Warp Mills.

NEW HAMPSHIRE.

Charlestown	Samuel Webber	Hydraulic Engineer.
Claremont	Frank P. Vogl	Monadnock Mills.
Dover	John Drowne	Cocheco Manufg. Co.
Dover	Charles H. Fish	Cocheco Manufg. Co.
Dover	John Holland	12 Trackey St.

Exeter	Hervey Kent	Exeter Manufg. Co.
Greenville	Frederick W. Ely	Columbian Manufg. Co.
Manchester	Stephen N. Bourne	Stark Mills.
Manchester	French Campbell	Commission Merchant.
Manchester	George A. Clark	Manchester Mills.
Manchester	D. D. Felton	S. A. Felton & Son Co.
Manchester	Elliott Cowdin Lambert	Amoskeag Manufg. Co.
Manchester	Charles H. Manning	Amoskeag Manufg. Co.
Manchester	Charles D. McDuffie	Manchester Mills.
Manchester	Herman F. Straw	Amoskeag Manufg. Co.
Manchester	George F. Whitten	Amory Manufg. Co.
Manchester	John H. Whitten	Stark Mills.
Milford	M. F. Foster	
Milford	Frank E. Kaley	Morse & Kaley Manufg. Co.
Nashua	William D. Cadwell	Nashua Manufg. Co. & Jackson Co.
Nashua	Roscoe S. Milliken	Nashua Mfg. Co.
Pittsfield	George E. Kent	Exeter Manufg. Co.
Salmon Falls	O. S. Brown	Salmon Falls Manufg. Co.
Somersworth	Charles H. Plummer	Great Falls Manufg. Co.
Suncook	David L. Jewell	China, Webster & Pembroke Mills.
Suncook	Edmund E. Truesdell	China, Webster & Pembroke Mills.

VERMONT.

North Pownal	Thomas Armstrong	North Pownal Manufg. Co.

MASSACHUSETTS.

Adams	John S. Adams, Jr.	Adams Bros. Manufg. Co.
Adams	Z. D. Hall	Berkshire Cotton Manufg. Co.
Adams	A. B. Mole	Greylock Mill.
Adams	Charles T. Plunkett	Berkshire Cotton Manufg. Co.
Adams	James Renfrew	Renfrew Manufg. Co.
Amesbury	Henry D. Martin	Hamilton Woolen Co.
Amesbury	M. W. Quinn	Hamilton Woolen Co.
Andover	John W. Bell	Smith & Dove Manufg. Co.
Barre, Smithville	George W. Robbins	Barre Cotton Mill.
Belmont	John Kilburn	
Blackstone	Edward A. Mongeon	Blackstone Manufg. Co.
Bondsville	B. A. Alexander	Boston Duck Co.
Bondsville	Elmer G. Childs	Boston Duck Co.
Boston	Charles B. Amory	70 Kilby St.
Boston	Frederick Amory	40 Water St.
Boston	Edward Atkinson	31 Milk St.
Boston	E. W. Atkinson	152 Congress St.

Boston	Joseph P. Battles	150 Devonshire St.
Boston	Frank P. Bennett	148 Pearl St.
Boston	A. M. Benson	27 Kilby St.
Boston	J. Payson Bradley	24 Purchase St.
Boston	Henry G. Brinckerhoff	321 Exchange Building.
Boston	John H. Burghardt	31 Pearl St.
Boston	Alfred Clarke,	Mech. Eng., 23 Central St.
Boston	Frank B. Comins	45 Milk St., Room 44.
Boston	Alphonse S. Covel	70 Kilby St.
Boston	Ambrose Eastman	53 State St.
Boston	William Firth	150 Devonshire St.
Boston	Redington Fiske	89 State St.
Boston	Alfred M. Goodale	50 State St.
Boston	Stephen Greene	131 Devonshire St.
Boston	Franklin W. Hobbs	Arlington Mills.
Boston	John Hogg	140 Essex St.
Boston	Henry S. Howe	68 Chauncy St.
Boston	William B. Kehew	24 Purchase St.
Boston	Evan Arthur Leigh	70 Kilby St.
Boston	William C. Lovering	40 Water St.
Boston	George A. Lowry	89 State St.
Boston	Herbert Lyman	95 Milk St.
Boston	Charles T. Main	1112 Exchange Building.
Boston	Fred C. McDuffie	40 Water St.
Boston	H. G. McKerrow	31 State St.
Boston	George H. Meader	35 Oliver St.
Boston	George B. Morison	95 Milk St.
Boston	William R. Noone	100 Pearl St.
Boston	Sidney B. Paine	200 Summer St.
Boston	Francis J. Parker	27 Kilby St.
Boston	Benjamin Phipps	4 Winthrop Sq.
Boston	Charles F. Randall	350 Tremont Building.
Boston	Charles E. Riley	281 Congress St.
Boston	C. E. Roberts	125 Milk St.
Boston	Arnold B. Sanford	45 Milk St.
Boston	Henry B. Sawyer	45 Milk St.
Boston	J. Herbert Sawyer	45 Milk St.
Boston	H. T. Schaefer	5 Custom House St.
Boston	George H Shapley	78 Chauncy St.
Boston	Willis S. Shepard	93 Commercial St.
Boston	William F. Sherman	27 State St.
Boston	Lewis R. Speare	369 Atlantic Ave.
Boston	Winthrop Thayer	1015 Tremont Building.
Boston	James P. Tolman	115 Congress St.
Boston	Charles D. Turnbull	The Ludlow.
Boston	Frank H. Underwood	137 Purchase St.

Boston	Stephen M. Weld	Cotton Buyer, 89 State St.
Boston	Erving Yale Woolley	152 Congress St.
Cambridgeport	James H. Kendall	Edward Kendall & Sons.
Canton Junction	Joseph W. Wattles	Manufacturers' Supplies.
Chicopee Falls	Henry A. Bailey	Chicopee Manufg. Co.
Clinton	William G. McLoon	Lancaster Mills.
Clinton	Charles H. Richardson	Lancaster Mills.
Clinton	George P. Taylor	
Clinton	George W. Weeks	
Fall River	F. S. Akin	Cornell Mills.
Fall River	Henry Ashworth	Card Clothing Manufr.
Fall River	John P. Bodge	Arkwright Mills.
Fall River	Jefferson Borden, Jr.	Fall River Bleachery.
Fall River	Nathaniel B. Borden	Barnard Manufg. Co.
Fall River	Richard B. Borden	Troy C. & W. Manufg. Co.
Fall River	Thomas J. Borden	Richard Borden Manufg. Co.
Fall River	Isaac A. Brown	Narragansett Mills.
Fall River	George A. Chace	Bourne Mills.
Fall River	Simeon B. Chase	King Phillip Mills.
Fall River	John A. Collins	American Linen Co.
Fall River	B. D. Davol	Barnard Manufg. Co.
Fall River	Frank H. Dwelly	Tecumseh Mills.
Fall River	David H. Dyer	7 and 8 Pocasset Bank Building.
Fall River	William Evans	Richard Borden Manufg. Co.
Fall River	John T. Fyans	411 Beach St.
Fall River	Daniel Gilligan	Pocasset & Metacomet Mills.
Fall River	John Gregson	Merchants Mfg. Co.
Fall River	Effingham C. Haight	Wampanoag Mills.
Fall River	A. M. Hamilton	Parker Mills.
Fall River	John F. Hamlet	P. O. Box 160.
Fall River	Alfred H. Hartley	Oils and Mill Supplies.
Fall River	Samuel E. Hathaway	Fall River Iron Works Co.
Fall River	William Hathaway	Barnard Mfg. Co.
Fall River	William B. Hawes	North Dighton Cotton Co.
Fall River	George H. Hills	Davol Mills and Stevens Mfg. Co.
Fall River	Thomas Horsfield	3 Albion St.
Fall River	Edward B. Jennings	Globe Yarn Mills.
Fall River	Benjamin B. Kirk	2107 South Main St.
Fall River	George H. Law	815 Walnut St.
Fall River	Leontine Lincoln	Seaconnet Mills.
Fall River	John R. Mason	439 Middle St.
Fall River	Philip A. Mathewson	King Philip Mills.
Fall River	Thomas McAuliffe	Stevens Manufg. Co.
Fall River	J. Edward Osborne	American Linen Co.
Fall River	Joseph H. Potter, Jr.	Durfee Mills.
Fall River	Charles M. Shove	Granite Mills.

Fall River	J. C. Smith	Chace Mills.
Fall River	Robert Stewart	Shove Mills.
Fall River	John Sullivan	Union Cotton Mills.
Fall River	Timothy Sullivan	Davol Mills.
Fall River	Albert A. Sweet	36 Rockland St.
Fall River	Abbott E. Slade	Laurel Lake Mills.
Fall River	Richard Thackeray	Weetamoe Mills.
Fall River	Horace W. Tinkham	Robeson Mills.
Fall River	George F. Tryon	199 Purchase St.
Fall River	Robinson Walmsley	Tecumseh Mills.
Fall River	Arthur J. Warren	Star Harness Co.
Fiskdale	Oscar B. Truesdell	Fiskdale Mills.
Fitchburg	George P. Grant, Jr.	Grant Yarn Co.
Fitchburg	W. E. Keach	123 Myrtle Ave.
Fitchburg	Arthur H. Lowe	Parkhill Manufg Co.
Fitchburg	David Lowe	Parkhill Manufg. Co.
Fitchburg	Thomas C. Sheldon	Fitchburg Duck Mills.
Fitchburg	Walter F. Stiles	Orswell Mills.
Fitchburg	Ralph E. Thomspon	Parkhill Manufg. Co.
Great Barrington	Jno. H. C. Church	Monument Mills.
Griswoldville	James C. Deane	Griswoldville Manufg. Co.
Holyoke	Jones S. Davis	6 Newton Street.
Holyoke	John W. Dickinson	Lyman Mills.
Holyoke	Joseph M. Dunham	190 Walnut St.
Holyoke	Ernest Lovering	Lyman Mills.
Holyoke	C. W. Rider	Merrick Thread Co.
Holyoke	W. Marshall Taylor	Merrick Thread Co.
Hopedale	Eben S. Draper	Draper Co.
Hopedale	George A. Draper	Draper Co.
Hopedale	George Otis Draper	Draper Co.
Hopedale	William F. Draper	Draper Co.
Hopedale	William F. Draper, Jr.	Draper Co.
Housatonic	T. G. Ramsdell	Monument Mills.
Indian Orchard	William C. Godfrey	Indian Orchard Co.
Indian Orchard	Henry C. Spence	Metallic Drawing Roll Co.
Indian Orchard	James Strang	123 Hampden St.
Ipswich	James W. Brown	Box 312.
Lawrence	William A. Barrell	Lawrence Duck Co.
Lawrence	Eugene E. Burnham	252 Lowell St.
Lawrence	Frederick E. Clarke	Pres. B. & L. R. R.
Lawrence	William J. Hadfield	225 Bailey St.
Lawrence	William D. Hartshorne	Arlington Mills.
Lawrence	James I. Milliken	Everett Mills.
Lawrence	Walter E. Parker	217 Haverhill St.
Lawrence	Robert Redford	
Lawrence	Charles M. Sears	Atlantic Cotton Mills.

Lawrence	Francis H. Silsbee	Pacific Mills.
Lawrence	George W. Towne	Arlington Mills.
Lawrence	William D. Twiss	Everett Mills.
Lawrence	William S. Whitney	Washington Mills Co.
Lawrence	Eben C. Willey	Atlantic Mills.
Leicester	Charles A. Denny	American Card Clothing Co.
Linwood	Arba C. Slater	Linwood Mills.
Linwood	Fred B. Whitin	Uxbridge Cotton Mills.
Lowell	George E. Ames	Lawrence Manufg. Co.
Lowell	Frank A. Bowen	Appleton Co.
Lowell	Edward N. Burke	Lowell Machine Shop.
Lowell	W. W. Carey	Machinery and Pulley Manufacturer
Lowell	Clarence N. Childs	43 Pine St.
Lowell	Alonzo A. Coburn	Atherton Machine Co.
Lowell	A. G. Cumnock	Appleton Co.
Lowell	Albert W. Danforth	881 Bridge St.
Lowell	Edward P. Dennis	Lowell Machine Shop.
Lowell	C. E. W. Dow	67 Burtt St.
Lowell	William A. Eastman	Lowell Hosiery Co.
Lowell	T. C. Entwistle	323 Market St.
Lowell	Frederick A. Flather	Lowell Machine Shop.
Lowell	Royal W. Gates	307 Market St.
Lowell	William E. Hall	Shaw Stocking Co.
Lowell	James G. Hill	Merrimack House.
Lowell	George L. Hooper	7 Belmont Street.
Lowell	Alfred W. Hunking	374 Stevens St.
Lowell	Nathaniel B. Kerr	Boott Cotton Mills.
Lowell	Alvin S. Lyon	Lowell Manufg. Co.
Lowell	Albert H. Morton	Kitson Machine Co.
Lowell	Oliver H. Moulton	Hamilton Manufg. Co.
Lowell	Franklin Nourse	Lawrence Manufg. Co.
Lowell	John W. Pead	Merrimac Manufg. Co.
Lowell	Haven C. Perham	Kitson Machine Co.
Lowell	M. A. Rawlinson	Tremont & Suffolk Mills.
Lowell	William S. Southworth	Mass. Cotton Mills.
Lowell	Edward W. Thomas	Tremont and Suffolk Mills.
Lowell	Charles T. Upton	Shaw Stocking Co.
Lowell	Jude C. Wadleigh	Mass. Cotton Mills.
Lowell	Frederick T. Walsh	Lowell Bleachery & Dye Works.
Lowell	Walter S. Watson	Haworth & Watson Manufg. Co.
Lowell	Channing Whitaker	Lowell Machine Shop.
Lynn	C. J. H. Woodbury	Secy. and Treas.
Manchaug	Charles M. Holmes	Manchaug Co.
Methuen	Lewis E. Barnes	Pemberton Co. and Methuen Co.
Methuen	G. B. Emmons	Emmons Loom Harness Co.
Millbury	Fred W. Moore	Cordis Mills.

Millbury	Henry M. Wilcox	John Rhodes Warp Co.
New Bedford	George A. Ayer	123 Fifth St.
New Bedford	Christopher P. Brooks	New Bedford Textile School.
New Bedford	Robert Burgess	Grinnell Mfg. Corp.
New Bedford	Byron F. Card	Howland Mills.
New Bedford	William W. Crapo	Wamsutta Mills.
New Bedford	P. Y. DeNormandie	Potomska Mills.
New Bedford	Frederick Grinnell	Gen. Fire Extinguisher Co.
New Bedford	Henry A. Holcomb	Box 249.
New Bedford	Walter H. Langshaw	Dartmouth Manufg. Corp.
New Bedford	Stephen C. Lowe	87 Union St.
New Bedford	Andrew G. Pierce, Jr.	Box 34.
New Bedford	Herbert E. Walmsley	Wamsutta Mills.
New Bedford	William R. West	830 Purchase St.
Newton	Josiah G. Coburn	
Newton Upper Falls	Frank J. Hale	Saco and Pettee Machine Shops.
Newton Upper Falls	R. P. Snelling	Saco and Pettee Machine Shops.
North Adams	Hervey Burnham	Beaver Mills and Eclipse Mill.
North Adams	Charles W. Dennett	Johnson Manufg. Co. and Dunbar Mills Co.
Northbridge	Henry S. Houghton, Jr.	Paul Whitin Manufg. Co.
Northbridge	Henry T. Whitin	Paul Whitin Manufg. Co.
North Cambridge	Colin C. Bell	Laminar Fibre Co.
North Oxford	Edwin N. Bartlett	Sigourney and Rockdale Mills.
North Plymouth	Gideon F. Holmes	Plymouth Cordage Co.
Oakdale	William B. Fittz	W. Boylston Manufg. Co.
Oakdale	Alfred N. Whiting	L. M. Harris Manufg. Co.
Reedville	George E. Spofford	Reedville Cotton Mills.
Salem	C. F. Curwen	Dinsmore Mfg. Co.
Salem	William P. McMullen	Naumkeag Steam Cotton Co.
Salem	N. G. Simonds	Naumkeag Steam Cotton Co.
Saundersville	Thomas Wilmarth	Saunders Cotton Mills.
Shattuckville	Frank S. Field	Massaemit Yarn Mills.
South Hadley Falls	William R. Hill	Glasgow Manufg. Co.
Taunton	A. C. Bent	Safety Seamless Pocket Co.
Taunton	William H. Bent	Mason Machine Works.
Taunton	John J. Connell	Cohannet Mills.
Taunton	Peter H. Corr	38 Court St.
Taunton	Thomas G. Cox	Mason Machine Works.
Taunton	P. T. Creed	Hopewell Mills.
Taunton	H. H. Culver	Elizabeth Poole Mill.
Taunton	Henry S. Culver	Westville Cotton Mill.
Taunton	Herbert Fisher	
Taunton	Abbott F. Lawrence	Nemasket Mills.
Taunton	Henry M. Lovering	Whittenton Manufg. Co.
Taunton	William M. Lovering	Whittenton Manufg. Co.

Taunton	Charles L. Macomber	Nemasket Mills.
Taunton	John Tempest Meats	Mason Machine Works.
Taunton	Herbert H. Shumway	Corr Manufg. Co.
Taunton	James W. Taylor	Canoe River Mills.
Taunton	Joseph S. Tidd	Oakland Mills.
Thorndike	Charles H. Hobbs	Thorndike Co.
Three Rivers	Roscius C. Newell	Palmer Mills.
Turners Falls	Samuel L. Parker	Turners Falls Cotton Mills.
Waltham	Charles L. Bailey	Boston Manufg. Co.
Waltham	Arthur C. Freeman	97 Church St.
Waltham	Charles E. Getchell	35 Willow St.
Ware	George E. Tucker	The Otis Co.
Webster	A. W. Brainerd	H. N. Slater Mills.
Webster	Ernest E. Clark	H. N. Slater Mills.
West Fitchburg	John Leiper	171 Blossom St.
West Warren	George A. Moody	Warren Cotton Mills.
Whitinsville	Alfred E. Adams	Whitinsville Cotton Mills and Linwood Mills.
Whitinsville	Josiah M. Lasell	The Whitin Machine Works.
Whitinsville	Oscar L. Owen	Whitin Machine Works.
Whitinsville	Cyrus A. Taft	Whitin Machine Works.
Whitinsville	Arthur F. Whitin	Saunders Cotton Mills.
Whitinsville	G. Marston Whitin	The Whitinsville Machine Works.
Williamstown Sta.	Roland R. Kelly	Williamstown Manufg. Co.
Winchendon	Z. L. White	White Brothers.
Worcester	George Crompton	Crompton & Knowles Loom Works
Worcester	Randolph Crompton	Crompton & Knowles Loom Works.
Worcester	Henry F. Harris	Room 509, State Mutual Building.
Worcester	C. H. Hutchins	Crompton & Knowles Loom Works.
Worcester	F. H. Rice	394 Pleasant St.
Worcester	John M. Russell	Crompton & Knowles Loom Works.
Worcester	Justin A. Ware	Crompton & Knowles Loom Works.
Worcester	W. W. White	Holyoke Machine Co.

RHODE ISLAND.

Allenton	R. A. Gray	Rodman Manufg. Co.
Ashton	Arthur H. Gulliver	Lonsdale Co.
Auburn	Albert F. Knight	
Bayside	Abel T. Atherton	Machine Maker.
Central Falls	Stephen L. Adams	Stafford Manufg. Co.
Central Falls	Louis B. Barker	United States Cotton Co.
Central Falls	B. F. G. Linnell	P. O. Box 645.
Central Falls	O. B. Parker	U. S. Cotton Co.
Centreville	Harold Lawton	Warwick Mills.
Centreville	Robert B. Treat	Centreville Cotton Mills.

Crompton	Charles D. Robinson	Crompton Co.
Davisville	Walter B. Knight	Reynolds Manufg. Co.
Fiskville	James Gee	Interlaken Dye Works.
Georgiaville	Herbert R. Farnum	Bernon Mills.
Hamilton	Joseph Warren Greene	Hamilton Web Co.
Manville	Charles Henry Savage	Manville Co.
Manville	A. Tenny White	Manville Co.
Natick	Webster Knight	Natick Mills.
Pawtucket	William W. Blades	135 Mineral Spring Ave.
Pawtucket	William P. Dempsey	Dempsey Bleachery & Dye Works.
Pawtucket	John J. Hart	Charlton Manufg. Co.
Pawtucket	David Jackson	Jackson Pat. Shell Roll Co.
Pawtucket	J. E. Jenckes	The E. Jenckes Manufg. Co.
Pawtucket	Ira J. Martin	62 Conant St.
Pawtucket	James R. MacColl	Lorraine Manufg. Co.
Pawtucket	F. C. Sayles	Ponemah Mills.
Pawtucket	William Whittam, Jr.	52 Samuel Ave.
Pawtucket	Fred A. Wilde	A. T. Atherton Machine Co.
Peace Dale	William C. Greene	Peace Dale Manufg. Co.
Phenix	Henry R. Brown	Hope Co. and Phenix Mill.
Pontiac	W. H. Summersby	Pontiac Mill and Bleachery.
Providence	Charles T. Aldrich	Aldrich Manufg. Co.
Providence	William Ames	47 Charles St.
Providence	H. C. Atwood	Williamsville Manufg. Co.
Providence	George R. Babbitt	182 South Water St.
Providence	Truman Beckwith	Dyerville Manufg. Co.
Providence	J. Frank Braids	212 Weybosset St.
Providence	D. Russell Brown	Butler Exchange.
Providence	H. Martin Brown	Butler Exchange.
Providence	E. C. Bucklin	Harris Manufg. Co. and Interlaken Mills.
Providence	Fred N. Bushnell	Narragansett Electric Light Co.
Providence	Charles H. Child	Butler Exchange.
Providence	Henry C. Clark	Standard Mill Supply Co.
Providence	Frederick I. Dana	Thomas Phillips Co.
Providence	A. Lockwood Danielson	Quinebaug Co.
Providence	J. DeForest Danielson	Lockwood Co. and Lewiston Bleachery and Dye Works.
Providence	John W. Danielson	Lockwood Co.
Providence	R. H. Deming	10 South Water St.
Providence	J. Herbert Foster	10 South Water St.
Providence	William Gammell	Berkeley Co.
Providence	Rufus B. Goff	77 Exchange Place.
Providence	William B. Gowdey	40 Clifford St.
Providence	William S. Granger	Granger Foundry & Machine Co.
Providence	Henry T. Grant, Jr.	723 Banigan Building.

Providence	David Grove	610 Manton Avenue.
Providence	John H. Hambley	49 Westminster St.
Providence	A. Walter Harris	326 South Water St.
Providence	F. A. W. Harris	Harris-Corliss Steam Engine Co.
Providence	Elisha H. Howard	309 Butler Exchange.
Providence	W. L. Hutchins	Crompton & Knowles Loom Works.
Providence	Joseph H. Kendrick	American Supply Co.
Providence	Jesse A. Knight	Lawton Spring Co.
Providence	Stephen A. Knight	Hebron Manufg. Co.
Providence	W. C. Langford	86 Weybosset St.
Providence	Charles W. Lippitt	Silver Spring B. & D. Co.
Providence	Henry F. Lippitt	Social and Manville Cos.
Providence	Charles R. Makepeace	Mill Engineer.
Providence	F. H. Maynard	Gen. Fire Extinguisher Co.
Providence	Thomas Mayor	26 Olney St.
Providence	George C. Newell	17 Custom House St.
Providence	William C. Peirce	564 Eddy St.
Providence	Reuben Pilling, Jr.	30 Hudson St.
Providence	Stephen Minot Pitman	Narragansett Mutual Fire Ins. Co.
Providence	Charles A. M. Praray	Banigan Building.
Providence	Richard H. Rice	521 South Main St.
Providence	Louis E. Robinson	20 Market Square.
Providence	Frank P. Sheldon	Industrial Trust Building.
Providence	Harry M. Smith	77 Exchange Place.
Providence	Wilton H. Spencer	7 Exchange Place.
Providence	George W. Stafford	Crompton & Knowles Loom Works.
Providence	Daniel J. Sully	T. M. Reynolds & Co.
Providence	Edward P. Taft	Ponemah Mills.
Providence	Robert W. Taft	Coventry Co. and Bernon Mills.
Providence	Charles F. Taylor	48 Custom House St.
Providence	D. M. Thompson	Corliss Steam Engine Co.
Providence	A. Curtis Tingley	7 Eddy St.
Providence	William P. Vaughan	Banigan Building.
Quidnick	Albert Knight	Quidnick Mills.
Riverpoint	Arthur F. Brackett	Royal Arctic and Valley Queen.
Riverpoint	C. Prescott Knight	Riverpoint Corp.
Slatersville	Charles F. Farrar	The Wm. A. Slater Mills Corp.
Slatersville	William P. Holt	The Wm. A. Slater Mills Corp.
Valley Falls	Arnold B. Chace, Jr.	Valley Falls Co. & Woonsocket Mills.
Valley Falls	Andrew J. Currier	Albion & Valley Falls Co.
Warren	Arnold Schaer	Warren Manufg. Co.
Warren	John Waterman	Warren Manufg. Co.
Westerly	Louis L. Hohn	122 High St.
Woonsocket	Malcolm Campbell	Woonsocket Mach. & Press Co.
Woonsocket	Charles H. Gorton	Glenark Knitting Co.
Woonsocket	Henry S. Houghton, Sr.	61 Pond St.

Woonsocket	Albert C. Hoy	Hamlet Mills.
Woonsocket	Charles H. Merriman, Jr.	Globe Mill.
Woonsocket	William A. Robinson	Social Manufg. Co.
Woonsocket	Earl A. Thissell	Woonsocket Bobbin Co.
Woonsocket	Ariel C. Thomas	93 Clinton St.
Woonsocket	Charles E. Thomas	44 Prospect St.

CONNECTICUT.

Baltic	Robert Rennie Taft	Baltic Power Co.
Danielson	James Herbert Smith	Quinebaug Co.
Glasgow	J. S. Wilbur	Glasgow Yarn Mills Co.
Hartford	William H. Stratton	95 Pearl St.
Jewett City	J. Colby Lewis	The Wm. A. Slater Mills Corp.
Jewett City	James O. Sweet	Ashland Cotton Co.
Jewett City	Adelbert R. Young	Ashland Cotton Co.
Killingly	W. E. Atwood	Williamsville Manufg. Co.
Killingly	C. H. Truesdell	Attawaugan Co.
Montville	Emory S. Rathburn	Pequot Mills.
New Hartford	Robert R. Smith	Greenwoods Co.
New Haven	George S. Barnum	The Bigelow Co.
No. Grosvenor Dale	Frank M. Messenger	Grosvenor Dale Co.
Norwich	W. N. Blackstone	Attawaugan Co.
Norwich	W. R. Burnham	Universal Loom Co.
Norwich	C. H. Frisbie	Attawaugan Co.
Norwich	Marcellus Gould	85 Sachem St.
Norwich	W. G. Henderson	Shetucket Co.
Norwich	Moses Pierce	274 Broadway.
Putnam	George W. Holt	Monohansett Manufg. Co.
Putnam	George A. Vaughan	Putnam Manufg. Co.
Taftville	Joseph D. Aiken	Ponemah Mills.
Taftville	John Eccles	Ponemah Mills.
Uncasville	Charles D. White	Uncasville Manufg. Co.
Wauregan	James A. Atwood	Wauregan Mills & Quinebaug Co.
Wauregan	John Walter Atwood	Wauregan Mills.
Willimantic	E. S. Boss	
Willimantic	John Scott	
Windsor Locks	J. R. Montgomery	J. R. Montgomery Co.

NEW YORK.

Capron	W. H. Cloher, Jr.	Utica Cotton Co.
Chadwicks	Bradford C. Divine	Utica Willow Vale Bleaching Co.
Cohoes	David S. Johnston	Cohoes Iron Foundry & Machine Co.
Cohoes	John E. Prest	Harmony Mills.
Hoosick Falls	O. W. Stites	

New York City	George Arms	Grand Hotel.
New York City	Edwin H. Baker	117 Duane St.
New York City	D. C. Ball	American Cotton Co.
New York City	Edward R. Ballou	540 West 23rd St.
New York City	John W. Ferguson	Postal Telegraph Building.
New York City	Dudley T. Lyall	541 West 23rd St.
New York City	William L. Lyall	540 West 23rd St.
New York City	Arthur B. Mann	99 Franklin St.
New York City	Arthur Parkinson	13 Gold St.
New York City	Duncan D. Parmly	49 Wall St.
New York City	Vladimir P. Polevoy	120 Broadway.
New York Mills, Oneida Co.,	John P. Campbell,	New York Mills.
New York Mills, Oneida Co.,	Henry C. Phillips,	New York Mills.
Oswego	George H. Sayward	Standard Yarn Co.
Utica	George DeForest	Utica Steam Cotton Mills.
Utica	D. W. Gray	Skenandoa Cotton Co.
Utica	Henry F. Mansfield	Utica Steam Cotton Mills.
Victory Mills	Joseph O. Hannum	Saratoga Victory Manufg. Co.

NEW JERSEY.

Gloucester City	Philip H. Fowler	
Jersey City	Ernest Bridge	Jas. Chadwick & Bro. Ltd.
Jersey City	Maxwell Grierson	Jas. Chadwick & Bro., Ltd.
Millville	John K. Russell	May's Landing Water Power Co.
Newark	William H. Loftus	Clark Thread Co.

PENNSYLVANIA.

Chester	D. Edwin Irving	The Irving & Leiper Manufg. Co.
Chester	W. T. Galey	Aberfoyle Manufg. Co.
Lancaster	S. S. Spencer	Conestoga Steam Mills.
Mt. Joy	Thomas J. Brown	George Brown's Sons.
Philadelphia	Robert Beatty	Coral and Adams Sts.
Philadelphia	T. Ashby Blythe	114 Chestnut St.
Philadelphia	Harry W. Butterworth	York & Cedar Sts.
Philadelphia	James Butterworth	York and Cedar Sts.
Philadelphia	Frederick A. Downes	925 Chestnut St.
Philadelphia	Edward W. France	320 South Broad St.
Philadelphia	Merrill A. Furbush	224 Market St.
Philadelphia	Joshua Garsed	Wingohocking Mills, Frankford.
Philadelphia	H. S. Grove	218 Race St.
Philadelphia	W. C. Houston, Jr.	333 Drexel Building.
Philadelphia	John H. Lorimer	Ontario and Lawrence Sts.
Philadelphia	David Milne	Washington Ave. and 11th St.

Philadelphia	George Wood	626 Chestnut St.
Philadelphia	John P. Wood	Spring Garden and 22nd St.
Trainer	William E. Trainer	D. Trainer & Sons Mfg. Co.

DELAWARE.

Wilmington	William P. Bancroft	Joseph Bancroft & Sons Co.
Wilmington	Daniel Moore Bates, Jr.	Joseph Bancroft & Sons Co.

MARYLAND.

Baltimore	James A. Gary	108 W. German St.

VIRGINIA.

Richmond	John W. Arrington	106 South 13th St.

NORTH CAROLINA.

Charlotte	R. M. Miller, Jr.	Atherton Mills.
Charlotte	E. A. Smith	Charlotte Supply Co.
Charlotte	D. A. Tompkins	Atherton Mills.
Charlotte	J. P. Wilson	Dover Yarn Mills.
Greensboro	Edward T. Garsed	Hucomuga Mills.
Hope Mills	Frank H. Cotton	Hope Mills Mfg. Co.
Kings Mountain	Philip S. Baker	Crowders Mt. Cotton Mills.
Kings Mountain	F. Dilling	Dilling Cotton Mills.
Kings Mountain	C. E. Falls	Enterprise Mills.
Lincolnton	R. S. Reinhardt	Elm Grove Cotton Mills.
Mountain Island	W. T. Jordan	Mt. Island Manufg. Co.

SOUTH CAROLINA.

Camden	James R. Pearce	Camden Cotton Mills.
Chester	William G. Nichols	Springsteine Mills.
Columbia	Charles K. Oliver	Columbia Mills Co.
Columbia	W. B. Smith-Whaley	1328 Main St.
Gaffney	H. D. Wheat	Gaffney Manufg. Co.
Lancaster	Leroy Springs	Lancaster Cotton Mills.
Langley	Arthur T. Smith	Langley Manufg. Co. and Aiken Manufg. Co.
Newberry	Edward B. Wilbur	Newberry Cotton Mills.
Orangeburg	Arthur Whittam	The Enterprise Cotton Mills.
Orangeburg	Samuel Dibble	Enterprise Cotton Mills.
Pelzer	B. F. Guy	Pelzer Manufg. Co.
Pelzer	Ellison A. Smyth	Pelzer Manufg. Co.

GEORGIA.

Atlanta	Oscar Elsas	Fulton Bag and Cotton Mills.
Atlanta	Henry E. Fisher	Atlanta Cotton Mills.
Augusta	Otis G. Lynch	Enterprise Manufg. Co.
Augusta	Joel Smith	J. P. King Mfg. Co.
Augusta	George R. Stearns	Riverside Mills.
Columbus	E. N. Clemence	Eagle & Phenix Mills.
Griffin, Spalding Co.	Albert G. Martin	Kincaid Manufg. Co.
La Grange,	Samuel Hale	Dixie Cotton Mills.
Macon	W. H. Richmond	Bibb Mill No. 2.

TENNESSEE.

Knoxville	William T. Lang	Brookside Mills.
Memphis	Jerome Hill	334 Front St.
Nashville	T. B. Dallas	Phenix Cotton Mills, Dallas Mfg. Co.

LOUISIANA.

New Orleans	S. Odenheimer	Lane Mills.

KENTUCKY.

Henderson	Paul J. Marrs	Henderson Cotton Mills.

ALABAMA.

Cordova	Albert W. Dimick	Indian Head Mills.
Cordova	John R. Rostron	Indian Head Mills.
Huntsville	T. W. Pratt	West Huntsville Cotton Mill Co.

TEXAS.

Galveston	Lawrence V. Elder	212 Tremont St.
Galveston	Theop. W. Wilmarth	Galveston City Cotton Mills.
Waco	Jno. Hopkinson	Slayden & Kirksey Woolen Mills.

CANADA.

Province of Ontario.

Hamilton, Ont.	Charles Owen Dexter	Canadian Colored Cotton Mills Ltd.
Hamilton, Ont.	A. T. Malcomson	92 Hunter St.
Hamilton, Ont.	James M. Young	Hamilton Cotton Co.

Province of Quebec.

Hochelaga, P. Q.	W. S. Hume	176 Notre Dame St.
Montreal, P. Q.	Alfred Hawkesworth	Merchants Cotton Co.
Montreal, P. Q.	Fred Hawkesworth	Merchants Cotton Co.
Magog, P. Q.	Harry W. Kimball	Dominion Cotton Mills Co.
Valleyfield, P. Q.	Fred Lacey	Montreal Cotton Co.
Valleyfield, P. Q.	Louis Simpson	Montreal Cotton Co.

NEW BRUNSWICK.

Marysville	John B. Cudlip	Gibson Cotton Mills.
Milltown	Lewis Dexter, Jr.	The Canadian Col'd Cot. Mill Co., Ltd.
Milltown	Farquharson J. Muir	St. Croix Cotton Co.
St. John	John H. Parks	Wm. Parks & Sons, Ltd.

RECAPITULATION.

LOCATION OF MEMBERSHIP.

Maine	17
New Hampshire	26
Vermont	1
Massachusetts	278
Rhode Island	106
Connecticut	29
New York	23
New Jersey	5
Pennsylvania	19
Delaware	2
Maryland	1
Virginia	1
North Carolina	11
South Carolina	12
Georgia	9
Kentucky	1
Tennessee	3
Louisiana	1
Alabama	3
Texas	3
Province of Ontario	3
Province of Quebec	6
New Brunswick	4
	564

IN MEMORIAM.

GEORGE A. FULLER.

GEORGE A. FULLER, for many years prominent in business circles connected with the cotton industry, died at his home in Providence, R. I., January 18, 1899. His death was the culmination of a five-days illness with pneumonia.

Mr. FULLER was best known as president of the American Card Clothing Co. of Providence, a concern which he had built up to its present standing. He was a native of Leicester, Mass., born in that town Nov. 7, 1827. The first of his family in this country were among the pilgrims who reached here in the Mayflower, a fact of which Mr. FULLER was justly proud. He was educated in the public schools at Leicester, and after leaving there learned the trade of card setting, the principal business of his native place, afterward going to Philadelphia, where he practiced his trade.

His father was a cotton manufacturer, and the son learned the operative processes at Waltham, Mass. On June 8, 1854, Mr. FULLER married MARTHA SCOTT of Leicester. Soon afterward he moved to Lawrence, then at its beginning as a manufacturing town. He followed his trade in Lawrence and three years after going there bought out his employers. From 1857 to 1890 he was engaged in the manufacture of card clothing under the name of the Stedman & Fuller Manufacturing Company. The business of this company was moved to Providence in 1885 and in

1890 was sold to the American Card Clothing Company of Worcester, Mass., Mr. FULLER remaining with the company as director and manager of the Providence branch. On the death of JOSEPH MURDOCK of Leicester Mr. FULLER was elected president of the American Card Clothing Company, a position which he held until his own death.

In addition to his interest in the company of which he was president, Mr. FULLER was president of the Mechanical Fabric Company of this city and vice-president of the Narragansett Mutual Fire Insurance Company.

Mr. FULLER was elected to various city offices during his residence in Lawrence and always took a deep interest in the affairs of that city. He was a deacon of the Congregational Church there. In Providence he was a member and deacon of the Union Congregational Church until its last change of pastors, when he resigned the office. He was well up in Masonic circles and a member of the Squantum, Hope and Athletic Clubs.

He became as Associate member of the Association on the first ballot which provided for that class of membership on Apr. 24, 1895, and often expressed a great interest in the organization, whose members will long miss his genial presence.

WILLIAM B. MUNROE.

WILLIAM B. MUNROE died at his home in Garwood, N. J., on the morning of March 30th, 1899. He was born in Smithfield, R. I., November 22d, 1841.

He entered cotton mill as master mechanic for Manville Manufacturing Company, Manville, R. I., in 1865. He was highly esteemed as a mechanic of great executive ability and remained in their employ for 18 years.

During this time he was chosen to fill many public positions

of trust, being member of school board, school trustee, member of town council and representative to state legislature. He was a republican, first, last and always.

He was a regular attendant of the Episcopal Church, interested in all that pertained to the betterment of mankind, large in his charities, genial and kind, never forgetting old friends. Many were the regrets of friends and neighbors when he accepted the position of Superintendent for Millville Manufacturing Company, Millville, N. J., which position he acceptably filled for twelve years, making in this community hosts of friends and serving as member of city council. He was a member of the Masonic order, also I. O. O. F.

He became a member of this Association October 24, 1895, and took a deep interest in the meetings, which he constantly attended, but his reticence prevented him from entering actively into the presentation of papers or joining into the debates upon subjects which he would discuss freely in conversation with his friends. The funeral took place Tuesday, April 4th, from St. James Church, Woonsocket, R. I.

CAPTAIN H. S. CHADWICK.

HUBERT SMITH CHADWICK was born in Enosburg, Vt., September 22, 1856, and died at Boston, Mass., March 2, 1899. His parents died when he was young, leaving three children, two girls and a son. Mr. CHADWICK became draughtsman when he left school, and after following that occupation in Worcester and Providence, he became draughtsman and selling agent for the Franklin Foundry and Machine Company of Providence, R. I. He came South on business for that company, selling his first bill of goods in Charlotte, N. C., to the Ada Mills. He liked the place and as he was given a Southern field,

made Charlotte his headquarters. This was in 1887. In 1892 he organized the Charlotte Machine Company, of which he was president, treasurer and manager up to the time of going to the war, when Mr. A. H. WASHBURN was made manager. He was thoroughly identified with the industrial life and advancement of that city and section. He was president for several years of the Dover Mill at Pineville; was president at the time of his death of the Dilling Mill at King's Mountain; was president of the Louise Mill, until recently, and was interested in other industrial enterprises.

When the Manufacturers' Club was organized at Charlotte, N. C., in July, 1894, Mr. CHADWICK was elected president. He held the office until February, 1899, when he resigned and Mr. VINTON LIDDELL succeeded him. He was an ideal president—hospitable, energetic and quick to take hold of any scheme that would benefit the organization.

The members of this Association who visited Charlotte on the trip to the Atlanta Meeting in October, 1895, will ever remember the hospitality of the occasion and the cordiality of Mr. CHADWICK.

In June, 1897, Mr. CHADWICK was elected captain of the Queen City Guards. He took a lively interest in the company, and at once won the confidence and affection of his men. When the war with Spain broke out, although he had large business interests at stake, he enlisted with his men and left here with them last May, for the service. He was known as one of the best officers in the camp. His men were devoted to him and he was universally kind and considerate to them. During his absence in camp, he was presented with a handsome sword from his many friends in Charlotte.

PROCEEDINGS.

In accordance with the legal notice the stated semi-annual meeting of the Association was held in Chipman Hall, Boston, Mass., April 26th and 27th, 1899. The following 287 members and guests were present.

ACTIVE MEMBERS.

ALFRED E. ADAMS, Whitinsville, Mass.
THOMAS ARMSTRONG, No. Pownal, Vt.
ABEL T. ATHERTON, Bay Side, R. I.
EDWARD ATKINSON, Boston, Mass.
E. W. ATKINSON, Boston, Mass.
H. C. ATWOOD, Providence, R. I.
W. E. ATWOOD, Killingly, Conn.
GEORGE A. AYER, New Bedford, Mass.
CHARLES L. BAILEY, Waltham, Mass.
EDWARD R. BALLOU, New York, N. Y.
LOUIS D. BARKER, Central Falls, R. I.
EDWIN N. BARTLETT, North Oxford, Mass.
DANIEL MOORE BATES, Jr., Wilmington, Del.
JOSEPH P. BATTLES, Boston, Mass.
STEPHEN N. BOURNE, Manchester, N. H.
FRANK A. BOWEN, Lowell, Mass.
A. W. BRAINERD, Webster, Mass.
CHRISTOPHER P. BROOKS, New Bedford, Mass.
HENRY R. BROWN, Phenix, R. I.
ROBERT BURGESS, New Bedford, Mass.

EDWARD N. BURKE, Lowell, Mass.
HERVEY BURNHAM, North Adams, Mass.
BYRON F. CARD, New Bedford, Mass.
GEORGE A. CHACE, Fall River, Mass.
ELMER G. CHILDS, Bondsville, Mass.
FRANK B. COMINS, Boston, Mass.
JOHN J. CONNELL, Taunton, Mass.
FRANK H. COTTON, Hope Mills, N. C.
P. T. CREED, Taunton, Mass.
JOHN B. CUDLIP, Marysville, New Brunswick.
H. H. CULVER, Taunton, Mass.
HENRY S. CULVER, Taunton, Mass.
PHILIP DANA, Westbrook, Me.
WOODBURY K. DANA, Westbrook, Me.
J. DEFOREST DANIELSON, Providence, R. I.
WILLIAM P. DEMPSEY, Pawtucket, R. I.
CHARLES W. DENNETT, North Adams, Mass.
EDWARD P. DENNIS, Lowell, Mass.
CHARLES A. DENNY, Leicester, Mass.
P. Y. DENORMANDIE, New Bedford, Mass.
BRADFORD C. DIVINE, Chadwicks, N. Y.
EBEN S. DRAPER, Hopedale, Mass.
RUSSELL W. EATON, Brunswick, Me.
JOHN ECCLES, Taftville, Conn.
FREDERICK W. ELY, Greenville, N. H.
WILLIAM EVANS, Fall River, Mass.
WILLIAM FIRTH, Boston, Mass.
CHARLES H. FISH, Dover, N. H.
HERBERT FISHER, Taunton, Mass.
WILLIAM B. FITTZ, Oakdale, Mass.
FREDERICK A. FLATHER, Lowell, Mass.
M. F. FOSTER, Milford, N. H.
ARTHUR C. FREEMAN, Waltham, Mass.
JOSHUA GARSED, Philadelphia, Pa.
CHARLES E. GETCHELL, Waltham, Mass.
DANIEL GILLIGAN, Fall River, Mass.
ALFRED M. GOODALE, Boston, Mass.
CHARLES H. GORTON, Woonsocket, R. I.
D. W. GRAY, Utica, N. Y.

R. A. Gray, Allenton, R. I.
John Gregson, Fall River, Mass.
David Grove, Providence, R. I.
Arthur H. Gulliver, Ashton, R. I.
William J. Hadfield, Lawrence, Mass.
Z. D. Hall, Adams, Mass.
A. M. Hamilton, Fall River, Mass.
John F. Hamlet, Fall River, Mass.
William D. Hartshorne, Methuen, Mass.
Samuel E. Hathaway, Fall River, Mass.
William B. Hawes, Fall River, Mass.
Alfred Hawkesworth, Montreal, P. Q.
Fred Hawkesworth, Montreal, P. Q.
William Hayes, Auburn, Me.
W. G. Henderson, Norwich, Conn.
James G. Hill, Lowell, Mass.
Charles H. Hobbs, Thorndike, Mass.
Franklin W. Hobbs, Boston, Mass.
Charles M. Holmes, Manchaug, Mass.
Gideon F. Holmes, No. Plymouth, Mass.
George W. Holt, Putnam, Conn.
Thomas Horsfield, Fall River, Mass.
Henry S. Houghton, Jr., Northbridge, Mass.
W. C. Houston, Philadelphia, Pa.
Edward B. Jennings, Fall River, Mass.
David S. Johnston, Cohoes, N. Y.
W. E. Keach, Fitchburg, Mass.
Roland P. Kelly, Williamstown Station, Mass.
Joseph H. Kendrick, Providence, R. I.
Nathaniel B. Kerr, Lowell, Mass.
John Kilburn, Belmont, Mass.
Albert F. Knight, Auburn, R. I.
C. Prescott Knight, River Point, R. I.
Stephen A. Knight, Providence, R. I.
Webster Knight, Natick, R. I.
Fred Lacey, Valleyfield, P. Q.
Walter H. Langshaw, New Bedford, Mass.
Harold Lawton, Centerville, R. I.
Evan Arthur Leigh, Boston, Mass.

J. Colby Lewis, Jewett City, Ct.
William H. Loftus, Newark, N. J.
William C. Lovering, Boston, Mass.
Arthur H. Lowe, Fitchburg, Mass.
David Lowe, Fitchburg, Mass.
William L. Lyall, New York, N. Y.
Charles R. Makepeace, Providence, R. I.
Henry F. Mansfield, Utica, N. Y.
Thomas Mayor, Providence, R. I.
Robert McArthur, Biddeford, Me.
Fred C. McDuffie, Boston, Mass.
William P. McMullan, Salem, Mass.
John Tempest Meats, Taunton, Mass.
W. H. Miles, Lisbon, Me.
James I. Milliken, Lawrence, Mass.
Roscoe S. Milliken, Nashua, N. H.
A. B. Mole, Adams, Mass.
Edward A. Mongeon, Blackstone, Mass.
George A. Moody, West Warren, Mass.
Fred W. Moore, Millbury, Mass.
Albert H. Morton, Lowell, Mass.
Oliver H. Moulton, Lowell, Mass.
Farquharson J. Muir, Milltown, New Brunswick.
Roscious C. Newell, Three Rivers, Mass.
William G. Nichols, Chester, S. C.
O. B. Parker, Central Falls, R. I.
Walter E. Parker, Lawrence, Mass.
William C. Peirce, Providence, R. I.
Haven C. Perham, Lowell, Mass.
Joseph H. Potter, Jr., Fall River, Mass.
Herbert L. Pratt, Lewiston, Me.
John E. Prest, Cohoes, N. Y.
T. G. Ramsdell, Housatonic, Mass.
Robert Redford, Lawrence, Mass.
Roscoe C. Reynolds, Lewiston, Me.
Charles D. Robinson, Crompton, R. I.
John K. Russell, Millville, N. J.
Arnold B. Sanford, Boston, Mass.
William F. Sherman, Boston, Mass.

HERBERT H. SHUMWAY, Taunton, Mass.
N. G. SIMONDS, Salem, Mass.
LOUIS SIMPSON, Valleyfield, P. Q.
J. C. SMITH, Fall River, Mass.
ROBERT R. SMITH, New Hartford, Conn.
S. S. SPENCER, Lancaster, Pa.
WILTON H. SPENCER, Providence, R. I.
GEORGE E. SPOFFORD, Readville, Mass.
ROBERT STEWART, Fall River, Mass.
WALTER F. STILES, Fitchburg, Mass.
JOHN SULLIVAN, Fall River, Mass.
GEORGE P. TAYLOR, Clinton, Mass.
JAMES W. TAYLOR, Taunton, Mass.
EARL A. THISSELL, Woonsocket, R. I.
EDWARD W. THOMAS, Lowell, Mass.
RALPH E. THOMSON, Fitchburg, Mass.
JOSEPH S. TIDD, Taunton, Mass.
GEORGE W. TOWNE, Lawrence, Mass.
WILLIAM E. TRAINER, Trainer, Penn.
ROBERT B. TREAT, Centerville, R. I.
OSCAR B. TRUESDELL, Fiskdale, Mass.
GEORGE F. TRYON, Fall River, Mass.
WILLIAM D. TWISS, Lawrence, Mass.
HERBERT E. WALMSLEY, New Bedford, Mass.
ROBINSON WALMSLEY, Fall River, Mass.
JAMES A. WALSH, Lewiston, Me.
JOSEPH W. WATTLES, Canton Junction, Mass.
W. B. SMITH WHALEY, Columbia, S. C.
CHANNING WHITAKER, Lowell, Mass.
A. TENNY WHITE, Manville, R. I.
ALFRED N. WHITING, Oakdale, Mass.
GEORGE F. WHITTEN, Manchester, N. H.
J. S. WILBUR, Glasgow, Conn.
HENRY M. WILCOX, Millbury, Mass.
C. J. H. WOODBURY, Lynn, Mass.
ADELBERT R. YOUNG, Jewett City, Conn.

ASSOCIATE MEMBERS.

Henry Ashworth, Fall River, Mass.
D. C. Ball, New York, N. Y.
Colin C. Bell, No. Cambridge, Mass.
A. M. Benson, Boston, Mass.
J. Frank Braids, Providence, R. I.
Henry G. Brinckerhoff, Boston, Mass.
D. Russell Brown, Providence, R. I.
H. Martin Brown, Providence, R. I.
John H. Burghardt, Boston, Mass.
Eugene E. Burnham, Lawrence, Mass.
James Butterworth, Philadelphia, Pa.
W. W. Carey, Lowell, Mass.
Charles H. Child, Providence, R. I.
Peter H. Corr, Taunton, Mass.
C. F. Curwen, Salem, Mass.
Frederick I. Dana, Providence, R. I.
C. E. W. Dow, Lowell, Mass.
T. C. Entwistle, Lowell, Mass.
D. D. Felton, Manchester, N. H.
John T. Fyans, Fall River, Mass.
H. P. Garland, Biddeford, Me.
Royal W. Gates, Lowell, Mass.
Rufus B. Goff, Providence, R. I.
Henry T. Grant, Jr., Providence, R. I.
A. Walter Harris, Providence, R. I.
F. A. W. Harris, Providence, R. I.
Alfred H. Hartley, Fall River, Mass.
Henry S. Houghton, Sr., Woonsocket, R. I.
W. L. Hutchins, Providence, R. I.
David Jackson, Pawtucket, R. I.
James H. Kendall, Cambridgeport, Mass.
W. C. Langford, Providence, R. I.
Stephen C. Lowe, New Bedford, Mass.
George B. Morison, Boston, Mass.
William R. Noone, Boston, Mass.
Sidney B. Paine, Boston, Mass.
Stephen Minot Pitman, Providence, R. I.
Vladimir P. Polevoy, New York, N. Y.

Charles A. M. Praray, Providence, R. I.
Charles F. Randall, Boston, Mass.
John M. Russell, Worcester, Mass.
H. T. Schaefer, Boston, Mass.
Harry M. Smith, Providence, R. I.
R. Paul Snelling, Newton Upper Falls, Mass.
William H. Stratton, Hartford, Conn.
Charles F. Taylor, Providence, R. I.
Winthrop Thayer, Boston, Mass.
A. Curtis Tingley, Providence, R. I.
Justin A. Ware, Worcester, Mass.
Arthur J. Warren, Fall River, Mass.
W. S. Watson, Lowell, Mass.
William R. West, New Bedford, Mass.
W. W. White, Worcester, Mass.
Fred A. Wilde, Pawtucket, R. I.
Erving Yale Woolley, Boston, Mass.

GUESTS.

Eugene Andres, Boston, Mass.
Fr. Jac. Andres, Boston, Mass.
N. R. Ballagh, Boston, Mass.
W. W. Ballagh, New York, N. Y.
H. Bartholomew, Montreal, P. Q.
O. A. Barnard, Boston, Mass.
T. G. Bremer, Boston, Mass.
E. Brown, Worcester, Mass.
C. B. Burleigh, Boston, Mass.
G. S. Carney, Lowell, Mass.
B. P. Chapman, Boston, Mass.
P. W. Chisholm, Newtonville, Mass.
F. S. Cook, Boston, Mass.
S. L. Coombs, Providence, R. I.
C. D. Copp, Clinton, Mass.
James W. Cumnock, Boston, Mass.
Walter J. Denny, Leicester, Mass.
F. H. Dillon, Fitchburg, Mass.
D. D. Donovan, Providence, R. I.
B. Eldred, New York, N. Y.

A. H. Groll, Newark, N. J.
C. C. Garland, Manchester, N. H.
A. S. Grant, Lawrence, Mass.
P. L. Humphrey, Lowell, Mass.
L. Haughton, Boston, Mass.
M. A. Hays, Boston, Mass.
B. F. Jerrold, Boston, Mass.
J. E. Kendrick, Providence, R. I.
T. B. Kenney, Lowell, Mass.
W. L. Mallabar, Boston, Mass.
E. L. Merrow, Providence, R. I.
William A. McLeod, Boston, Mass.
J. S. Moore, Columbia, S. C.
Sumter Moore, Columbia, S. C.
W. C. Nairn, No. Cambridge, Mass.
S. N. D. North, Boston, Mass.
H. F. Palmer, Norwich, Conn.
E. T. Peirce, New Bedford, Mass.
A. F. Ray, Boston, Mass.
J. S. Sedgwick, Boston, Mass.
A. N. Smith, No. Pownal, Vt.
J. F. Smith, Salem, Mass.
J. R. Smith, Boston, Mass.
James T. Smith, Lowell, Mass.
H. E. Stafford, Providence, R. I.
S. G. Steinmetz, Philadelphia, Pa.
T. B. Stimpson, Providence, R. I.
C. T. Switzler, Boston, Mass.
B. S. Terry, Providence, R. I.
E. W. S. Tingle, Philadelphia, Pa.
A. W. Trafford, Fall River, Mass.
H. R. Trainer, Boston, Mass.
W. C. Trainer, No. Cambridge, Mass.
B. G. Underwood, Boston, Mass.
E. F. Verdery, Augusta, Me.
A. S. Wattles, Boston, Mass.
Franklin D. Williams, Boston, Mass.
J. Mullar Wilson.
Beverley Wood, Boston, Mass.

FIRST SESSION.

CHIPMAN HALL, BOSTON, MASS.
Wednesday, April 26, 1899.

Meeting called to order at 11 A. M., President STEPHEN A. KNIGHT in the chair.

The President read the following call to the meeting:

BOSTON, MASS., April 1, 1899.

To the Members —

Notice is hereby given that the stated Annual Meeting of this Association will be held at Boston, Mass., Wednesday and Thursday, April 26 and 27, 1899.

The sessions will be held in Chipman Hall, in the Tremont Temple, No. 88 Tremont Street, a short distance south of School Street, and opposite the Tremont Building. The entrance is at No. 88 Tremont Street, and Chipman Hall is on the sixth floor, reached by elevators.

The sessions will be called to order on Wednesday at 11, A. M., and 2, P. M., and on Thursday at 10, A. M., and 2, P. M.

By order of the Board of Government,

C. J. H. WOODBURY,

Secretary.

The Board of Government has not provided any entertainment, but the sessions will be held only during the day, leaving the evenings disengaged, in order that the members may arrange informal dinners in

such groups of friends as may desire to meet together, or avail themselves of the numerous attractions of the city, or other engagements.

The souvenir badges will be given to those members who are in attendance, and the Board of Government has given instructions that duplicates shall not be given until after the adjournment, but other souvenir badges will be given to the guests of members.

The Board of Government desires that applications for membership shall be received as far as possible in advance of the meeting. Blank propositions may be found on the inside front cover of the Transactions or will be sent on application.

Members who have overlooked their postal card receipts for Transactions are requested to give the matter attention, as it is only through this means that the headquarters of the Association are able to know that members receive the volumes and notices to which they are entitled.

It is the desire of the Board of Government that this meeting shall be one especially devoted to the discussion of the papers and topical questions. With that object in view, it is hoped that members will carefully examine the list of papers and topical questions, for the purpose of being prepared to add their contributions to the discussion.

Papers will be printed in advance for the use of members, as far as the manuscript may be sent to the Secretary in time, and copies will be sent to members on request, about a week before the meeting. Contributions of discussion in writing are solicited from members who will not be able to attend the meeting.

The full programme will not be issued until the meeting, but papers are expected on the following subjects:

Roller Ginning.

The Impairment of the Strength of the Cotton Fibre between the Field and the Cloth.

The Gray Goods from the Bleacher's and Finisher's Point of View.

What Belting is Made Of and Its Care.

Oiling Fly Frame Spindles.

The Drying of Cloth.

Depreciation of Textile Machinery.

Methods of Cost Finding in Cotton Mills.

Points on Sizing, Finishing and Packing of Goods.

Auxiliary Power Plants with Electrical Transmission.

Automatic Conveying of Cotton from Storehouse to Picker Room.

Industrial Institutions, their Organization and Regulation.

The Cotton Trade with Our Newly Acquired Territories.
The Competition of Southern Mills in 1850.
The Apparent Advantages of Driving Mills by Means of Electricity.
Fallacies Concerning the Electric Drive.

TOPICAL QUESTIONS.

107. What is the superiority of iron beams over those of Southern pine for mill floors?

108. What is the best method of coloring the inside walls of mills?

109. How can a card room be ventilated without undesirable currents of air?

110. What is the best way to keep mill hose for fire protection?

111. Are automatic sprinklers a necessity in the dust flues from pickers?

112. Is it economical to place compound condensing engines in a mill to supplement water wheels during the periods of low water, where the times of such service are short, and fuel expensive?

113. Are not second-hand machines quite as good for purposes of instruction in technical schools, as new ones?

114. Have the methods of sampling round bales proven satisfactory in practice?

115. What are the relative merits of arc and incandescent lights for weave rooms?

116. How far is it practicable to substitute frames for mules in spinning filling?

The SECRETARY. In accordance with Article 14 of the by-laws I certify that this call was mailed to each member at least ten days before the meeting and that a quorum is now present.

PROGRAMME, MEETING NO. 66.

CHIPMAN HALL, 88 TREMONT ST., BOSTON, MASS., APRIL 26-27, 1899.

First Session, Wednesday, April 26, 1899, at 11 A. M.

Call to Order.

Election of Officers.

Address.
His Honor, JOSIAH QUINCY, Mayor of Boston.

President's Address.
STEPHEN A. KNIGHT, Providence, R. I.

Report of Secretary and Treasurer.

Industrial Institutions, their Organization and Regulation.
HERBERT E. WALMSLEY, New Bedford, Mass.

Depreciation.
JOSEPH NASMITH, Manchester, England.

Competition of Southern Mills in 1850.
Compiled by the Secretary.

TOPICAL QUESTION.

107. Are not second-hand machines quite as good for purposes of instruction in technical schools, as new ones?

Second Session, Wednesday, April 26, 1899, at 2 P. M.

The Cotton Trade with Our Newly Acquired Territories.
Prof. WILLIAM P. WILSON, Sc. D.
Director Philadelphia Museums.

Methods of Cost Finding in Cotton Mills.
WILLIAM G. NICHOLS, Chester, S. C.

TOPICAL QUESTIONS.

108. What is the best way to keep mill hose for fire protection?

109. Are automatic sprinklers a necessity in the dust flues from pickers?

Gray Goods from the Bleacher's and Finisher's Point of View.
DANIEL MOORE BATES, Jr., Wilmington, Del.

The Drying of Cloth.
ALFRED A. HUNTING, Salem, Mass.

Points on Sizing, Finishing and Packing Goods.
ARTHUR PARKINSON, 13 Gold St., New York.

TOPICAL QUESTION.

110. Is it economical to place compound condensing engines in a mill to supplement water wheels during the periods of low water, where the times of such service are short, and fuel expensive?

Third Session, Thursday, April 27, 1899, at 10 A. M.

What Belting is Made Of, and Its Care.
PHILIP DANA, Westbrook, Maine.

TOPICAL QUESTIONS.

111. What is the superiority of iron beams over those of Southern pine for mill floors?

112. What is the best method of coloring the inside walls of mills?

113. How can a card room be ventilated without undesirable currents of air?

Auxiliary Power Plants with Electrical Transmission at Grosvenor Dale and Lyman Mills.
FRANK P. SHELDON, Providence, R. I.

The Advantages of the Electric Driven Cotton Mill.
W. B. SMITH WHALEY, Columbia, S. C.

Fallacies Concerning the Electric Drive.
SIDNEY B. PAINE, Boston, Mass.

TOPICAL QUESTIONS.

114. What are the relative merits of arc and incandescent lights for weave rooms?

115. How far is it practicable to substitute frames for mules in spinning filling?

Fourth Session, Thursday, April 27, 1899, at 2 P. M.

Oiling Fly Frame Spindles.*

RUSSELL W. EATON, Brunswick, Maine.

The Automatic Conveying of Cotton from Storehouse to Picker Room.

EDWARD W. THOMAS, Lowell, Mass.

Roller Ginning.

E. W. ATKINSON, Boston, Mass.

The Fibre of Cotton.

EDWARD ATKINSON, Boston, Mass.

TOPICAL QUESTION.

116. Have the methods of sampling round bales proven satisfactory in practice?

*Postponed until the Autumn Meeting.

The records of the last meeting were read by the Secretary and on motion of Col. JOSEPH H. KENDRICK, duly seconded, were accepted.

The PRESIDENT. The first business of the Association, gentlemen, is the election of officers for the ensuing year. The vacancies will be the President, two Vice-presidents and two Directors. What is your pleasure in this matter?

Mr. ARTHUR H. LOWE. Mr. President, I move that a committee of five be appointed by the President as a nominating committee to bring in a list of names to fill these vacancies.

The motion, being duly seconded, was put to vote and carried, and the President appointed for that committee Messrs. WALTER E. PARKER, S. S. SPENCER, ARTHUR H. LOWE, ROBERT MCARTHUR and EDWARD W. THOMAS.

The PRESIDENT. I suppose it is not necessary for that committee to convene until at their convenience, so as to give us the result of their deliberations at a future meeting.

I regret very much the inability of the Mayor to be with us this morning, because I had relied largely on him to say what it seemed to me really ought to be said to the Association. I learn at the last moment that the Mayor of Boston will not be able to be here this morning, therefore we shall have to lose the benefit of his address in the meeting.

The SECRETARY. Mr. President, the Mayor wrote me that he intended to speak before the meeting for fifteen or twenty minutes. This Association is an organization in which he has taken a great deal of interest. But I have just received the following letter from Mr. NAT. G. ROBINSON, secretary to the Mayor:

CITY OF BOSTON.
OFFICE OF THE MAYOR.

April 26, 1899.

C. J. H. WOODBURY, Esq.,
Secretary, N. E. Cotton Manufacturers' Association, 45 Milk St., Boston.

Dear Sir:—

Mayor QUINCY finds himself obliged to remain away from the city over today, and has dictated over the long distance telephone the enclosed letter to you.

Yours very truly,

NAT. G. ROBINSON.

Secretary.

(Enc.)

MAYOR'S OFFICE, CITY HALL, BOSTON.

April 26, 1899.

C. J. H. WOODBURY, Esq.,
Secretary, New England Cotton Manufacturers' Association, 45 Milk Street, Boston.

Dear Sir:—

I regret very much to be obliged to be unable to be present, as I had agreed, at the opening session of the New England Cotton Manufacturers' Association. I was obliged to be out of town yesterday, and I find myself unavoidably detained over today. I regret very much that I am therefore unable to extend a greeting to your organization on behalf of the city in person, and to express again, as I have done upon a former occasion, my sense of the value of such an organization and of its importance to one of our greatest New England industries. I have read with interest the advance sheets of some of the papers which are to be read at your session, and I am sure they will prove of value to your industry.

With best wishes for the full and entire success of yonr meeting, and with renewed regret that I am prevented from being present, I am

Very truly yours,

JOSIAH QUINCY,
Mayor.

PRESIDENT'S ADDRESS.

STEPHEN A. KNIGHT, Providence, R. I.

Gentlemen:—This is the sixty-sixth meeting of this Association, which was founded April 30, 1865. So we are now thirty-four years old, just in our prime. I am glad that so many of our members are able to be with us today, not only for the pleasure it gives me personally, but because it indicates a continued and permanent interest, on your part, in the affairs of the Association. Just here and now, I wish to thank our Board of Directors for the interest they have taken in the welfare and for the success of our organization, and also for the kind indulgence accorded to your President. It has indeed made the duty a pleasant one. I want to thank our efficient Secretary for his patience and for his valuable assistance to me, during the year; and I want to thank you, members of the Association, for your generous attendance and the interest you have taken thus far in the papers and questions which have been presented for our consideration.

Our meetings at the "Mountains" last fall, though not so fully attended as we had hoped, were full of interest. All the topics were heartily entered into and discussed with much fervor and intelligence, and, as a whole, the meeting was a pleasant success.

In point of numbers we are constantly gaining. Our membership is now 544 against 523 at the beginning of the year, showing a gain of 21 members. This does not include the applicants who are to be voted upon at this meeting. The applica-

tions that will be presented later on are numerous and the outlook is very encouraging.

I am pained to record the loss by death, during the year, of three of our members, GEORGE A. FULLER of Providence, R. I., Capt. H. S. CHADWICK of Charlotte, N. C. and WILLIAM B. MUNROE of Garland, N. J. Mr. FULLER was manager of the American Card Clothing Co., Providence, R. I., and a man of sterling worth. You will remember him for his fine physique and his genial social qualities. To know him was to appreciate him. Captain CHADWICK was president of the Dover Yarn Mills and the Dilling Cotton Mills, Charlotte, N. C. So many of you as were fortunate enough to take the journey to Atlanta with our Association, will remember him as one of our active entertainers while at Charlotte. A man just in the prime of life, he was loved and respected by all who knew him. Mr. MUNROE was formerly at Manville, R. I., and in later years occupied a position of greater responsibility in New Jersey. He was a man who was highly respected for his ability and character. In the death of these three men our Society suffers an irreparable loss.

Our finances are in a healthy condition, as will appear from our Treasurer's report. Just here I beg to repeat what I said in my remarks to you at our Fall meeting. It would be a help both to our treasury and Treasurer, if members would kindly send in their dues as soon as may be, after receiving their annual bills.

The Board of Government has, I believe, taken a very important step in the adoption of a "medal system," which our Secretary will explain in detail, as it is largely due to him that the system has been adopted, though the whole Board are heartily in its favor.

The dark clouds of adversity that hung so low and threatening over the cotton industry of New England, one year ago, have in a measure lifted, giving encouragement for our future. We are a nation of producers, and when the conditions of labor in the North and South are more nearly equalized (as they ultimately will be), and when the employer and employee better

understand the relations they hold one to the other, (as sooner or later they must,) with a tariff protection that will simply protect against the cheaply paid foreign labor, then and not till then will the onward march of our country be one of continued and unfailing prosperity. I would not have you infer from these remarks that I believe we have not prospered as a people or been blessed as a nation in the past. I believe quite the contrary. Taken as a whole and measured from 1800 to the present time, our growth has been almost phenomenal, and the developement of our industries marvelous. So much so that I have prepared a few figures, which I shall submit to you later on to show this wonderful progress. But our course has been very erratic and uneven, marked by eras of prosperity followed by years of depression; while under the conditions which I have indicated, I believe our course would be one of continued prosperity.

The past year has been an eventful one. The achievement of our Government has been in line with the work accomplished in 1776 when the Colonies threw off the yoke of bondage and declared for national independence, and in 1863 when our lamented Lincoln issued his Emancipation Proclamation, liberating millions of souls from the horrors of slavery. The present year has witnessed the ratification of the treaty between the United States and Spain, whereby millions more in Cuba and the Philippines, have been rescued from a condition of degradation and unjust oppression.

We are living in the last year of a century. With the end of this year 1800 and its fractions will be a thing of the past. As at the close of the year we naturally look back over and review what we have accomplished in the twelve months past, so we today, standing upon the threshold of a new century, instinctively look back over the record of the past one hundred years and note the changes that have taken place, and the progress that our country has made in that time. I am aware that statistics are dry and, as a rule, uninteresting but a short retrospective view of one hundred years ago as compared with today will be of interest to us. I have, as previously stated, prepared

a few figures which will show our growth as indicated by the increase in population, coinage, manufactures, saving institutions, etc. While it would be of interest to note the development of our agricultural and mineral resources, to observe the mechanical progress, the evolution of our monetary system, our comcommercial development, etc., time will, however, allow only the briefest mention of those subjects which I have selected.

I have found it very difficult to obtain information, of a reliable nature, as to the manufacturing industry or the wealth of our country during the early part of the century, on account of the meagreness of statistics on these points.

Hon. DAVID A. WELLS in an article on Progress in Manufactures, some years ago says: "The returns of the first and second census of 1790 and 1800 afforded no information concerning the aggregate wealth of the country, the occupation of the people or the nature and value of their annual products. While an attempt was made, in taking the third and fourth census, to gather information concerning the above mentioned subjects, the results obtained were considered of little importance. The act of 1850, however, marks an era in the history of American statistics, inasmuch as it not only incorporated provisions of law looking to the obtaining of results of substantial value relative to domestic industry, but also insured the observance of the law."

I believe that the growth of anything may be best shown by comparison or contrast, and the following tables have been arranged accordingly, I have sought to show the condition of things at three different periods of our history; namely, 1800, 1850 and 1890, the date of our last census, though in some instances there has been a slight deviation from this plan.

I shall not tax your patience with a recital of these statistics at this time. I have found them very interesting and trust that they may be equally so to you. I am, however, one of those who believe that figures, especially large combinations, are more easily comprehended when conveyed to the mind by the eye, rather than through the sense of hearing. Therefore I must

leave these statistics for you to read at your leisure, as they will appear in our records.

POPULATION.

Population of the United States in 1800,	3,929,827
" " " " " 1850,	23,263,488
" " " " " 1899,	77,803,231

The last figures are the results of careful estimate of the population January 1, 1899.

COINAGE.

Coinage at United States Mints from 1792 to 1800,	$1,962,800
" " " " " " 1800 " 1850,	193,111,910
" " " " " " 1850 " 1898,	2,476,572,064

SAVINGS BANKS.

	Number of Banks.	Number of Depositors.	Deposits.
In 1820,	10	8,635	$1,138,570
" 1850,	108	251,354	43,431,130
" 1898,	980	5,385,746	2,065,631,298

MANUFACTURES.

Number of hands employed,	1850	1,050,000
" " " "	1890	4,050,755
Value of raw material,	1850	$550,000,000
" " " "	1890	5,021,453,326
Value of product,	1850	$1,020,300,000
" " "	1890	9,056,764,996
Capital invested,	1850	$530,000,000
" "	1890	6,139,397,785

WEALTH.

Estimated wealth of the United States in 1850,	$7,154,680,228
" " " " " " 1890,	65,037,091,197

Special agent, J. K. UPTON, of the eleventh census, estimates

the increase of wealth from 1880 to 1890 to be 49 per cent., and that a proportionate increase from 1890 to 1900 would indicate a wealth of $100,000,000,000 at the beginning of the twentieth century.

For four years I have been an officer in this Association. I think I have attended every Board meeting except three, and have done all that has been practical for me to do for the success of our Society. I have enjoyed my connection in its official capacity, and when I go back to the ranks of common membership, as I do at the close of this meeting, shall remember with much pleasure the compliments paid me by the Association and the agreeable hours spent with our official Board.

Our next business will be the report of the Secretary and Treasurer.

TREASURER'S REPORT.

C. J. H. WOODBURY, TREASURER, IN ACCOUNT WITH THE NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION.

April 1, 1898, *to April* 1, 1899.

DEBTORS.

Cash,	$448 69	
Active membership dues,	2,105 00	
Associate membership dues,	890 00	
Active admission fees,	290 00	
Associate admission fees,	225 00	
Rent of desk room,	49 99	
Sale of Transactions and miscellaneous,	53 84	
Medal and certificate fund,	1,000 00	
Advertising,	1,045 00	
Interest,	54 73	
Total,		$6,162 25

CREDITORS.

Rent of office,	$537 46
Secretary and Treasurer,	729 17
Reports of meetings,	145 40
Notices and stationery,	64 50
Meeting expenses,	144 42
Board of Government,	208 00
Printing and distributing Transactions,	1,543 06
Advance copies of papers,	91 25
Amount forward,	$3,463 26

Amount forward,	$3,463 26	
Engraving,	119 03	
Badges,	65 50	
Stenographer and proof,	638 52	
Post office box,	10 00	
Postage, telegrams and express,	143 27	
Office supplies,	106 12	
Certificates of membership,	188 27	
Miscellaneous,	42 00	
Securities and cash,	1,386 28	
Total,		$6,162 25

AUDITOR'S REPORT.

I hereby certify that the amounts from April 1, 1898, to April 1, 1899, are correctly cast, that all payments are properly vouched for by bills approved by the Auditing Committee of the Board of Government, that the funds are kept on deposit in the name of the New England Cotton Manufacturers' Association, and that the amount of the deposit April 1, 1899, agrees with the balance on the books, viz., $386.28.

The security in which the Association funds have been invested has been examined.

J. HERBERT SAWYER,
Auditor.

BOSTON, April 12, 1899.

Although the relation of the Secretary and Treasurer to that of the testimonial fund to the Philadelphia Textile School was that of Trustee, and did not enter on the books of the Association, yet as it is desirable that all accounts should be passed upon by some competent authority, the book was submitted to the Auditor of the Association, and his report is appended herewith.

AUDITOR'S REPORT ON PHILADELPHIA TEXTILE SCHOOL TESTIMONIAL FUND.

I hereby certify that the accounts of C. J. H. Woodbury as Trustee of the fund for a testimonial to the Philadelphia Textile School, from

November 20, 1897, to December 19, 1898, are correctly cast, that all payments are vouched for by bills, and that the surplus of $10.64 was turned over to the New England Cotton Manufacturers' Association by the authority of the Board of Government, December 7, 1898.

J. HERBERT SAWYER,
Auditor.

BOSTON, Dec. 27, 1898.

The earnings of the Association may be placed as

451 active members at $5.00,	$2,255 00	
99 associate members at $10.00,	990 00	
33 active admissions at $10.00,	330 00	
9 associate admissions at $25.00,	225 00	
Advertising,	865 00	
Miscellaneous,	213 29	
Total,		$4,878 29

The expenses of the Association were $4,775.97.

The bills receivable are

Transactions,	$7 00	
Members,	385 00	
Advertisements,	130 00	
Total,		$522 00

There are no bills payable.

The income derived from advertisements has enabled the Association to be conducted on the same basis as other technical organizations which are supported by higher assessments as well as advertisements in their transactions.

The amounts from this source have amounted to in the several volumes of the transactions

63	Philadelphia, September, 1897,	$385 00
64	Boston, April, 1898,	420 00
65	Crawford House, September, 1898,	450 00
66	Boston, April, 1899 (already under contract),	420 00

This gives to the Association with minor miscellaneous income the financial advantages which would have resulted from the election of 488 active members, so that the Association is on a financial basis of over one thousand members, which it is expected to reach numerically in due time.

It would lighten the labors at the headquarters, and also advance the interests of the Association, if all dues were paid promptly, and also if the members would receipt for the Transactions. It is by these receipts that an effort is made to conduct your interests in a business like manner, and also to maintain a continued knowledge of the addresses of the membership, as there are frequent instances where members do not inform the Association of changes in address, which are far more frequent than might be assumed.

The following table gives the record of the finances of the Association during the past nine years:

MEMBERSHIP.			TRANSACTIONS.			FINANCES.				
Fiscal Year Ending April 1.	Enrollment.	Members Elected.	Volume Number.	Pages in Volume.	Pages for Year.	Cash Receipts.	Expenses.	Cost per Page of Transactions.	Cost per Member.	Cost per Page of Transactions for each member Cents.
1891	246	18	48 49	43 62	105	$1,142 00	$ 926 08	$8 82	$3 76	3.59
1892	254	12	50 51	129 60	189	1,260 68	1,374 46	7 27	5 41	2.86
1893	244	31	52 53	63 94	157	1,678 33	1,603 25	12 22	6 57	6.33
1894	259	19	54 55	84 86	170	1,414 58	1,807 60	10 63	7 03	4.14
1895	270 292	35	56 57	73 230	303	1,947 07	1,957 64	6 46	6 71	2.21
1896	383 422	142	58 59	310 327	637	4,579 19	3,636 31	5 71	8 59	1.34
1897	450 459	49	60 61	269 359	628	3,710 02	3,980 34	6 33	8 67	1.43
1898	495 523	83	62 63	353 433	786	4,717 08	4,333 85	5 51	8 28	1.18
1899	535 554	42	64 65	321 380	701	4,713 56	4,775 97	6 81	8 62	1.23

SECRETARY'S REPORT.

During the past year the Association has changed the headquarters from the John Hancock Building, which it has pleasantly occupied since January 20, 1895, to the International Trust Building, No. 45 Milk Street, Boston, where it now has the sole occupancy of the room, and the change has been one for the better in many respects, particularly in a very material saving to the expenses of the Association. These headquarters are frequently used by the members for business appointments and correspondence.

The Association has held two meetings during the year, whose record occupies seven hundred and one pages of Transactions which have been issued to the members. The supply of contributions has continued to keep up the value of the Transactions, and the Board of Government has, in many instances, authorized them to be placed in public libraries in manufacturing centers and those of several technical colleges.

It is the policy of the Association in its endeavor to improve the standards of cotton manufacturing, to welcome papers on the applications of the art, and questions subordinate to it, making a discrimination between technical matters which are necessarily the property of individuals possessing the experience and skill, and withholding from publication anything pertaining to the affairs of the individual establishments which are commercial in their nature, and not properly the subject of publication.

The Board of Government has held twelve meetings during the year, and also several sub-committee meetings, at which they have kept closely in touch with the affairs of the Association entrusted to them. The most important measure at their hands during the year, has been the establishment of a medal and the assigning of the fund of the Association for its maintenance. The Sub-committee of the Board of Government, to whom the details of the matter were entrusted, after the whole subject had received long continued and thorough investigation

by the whole Board, both in relation to the precedents of other organizations and the functions of this Association, made the following report:

The Board of Government established in 1895 a fund of one thousand dollars, the income of which was to be reserved as a resource for purposes beneficial to the Association.

In the fiscal year of 1897 this was applied to furnishing the members with certificates of membership, and the expense of continuing the supply to new members will be inconsiderable.

During the past year the Board decided to establish the New England Cotton Manufacturers' Association medal, and to use such parts of the income of this fund as may be necessary for the recognition of the merit in papers read before the Association, and the acknowledgments of the worth of inventions and methods contributing to the advancement of the cotton textile art.

It is the purpose of the Board of Government that this medal may be given to any person whose work has been, in their opinion, an advantage of sufficient importance to the purposes to which this organization is devoted in its broadest sense, including any papers read before the Association, the production of any mechanism or processes in the fabrication, design, or finishing of cotton goods, comprising mill construction, the generation of power and its distribution, or any of the works tributary to the cotton manufacture.

In the just award of this medal to the deserving, the Board of Government reserves the right to call to its assistance in determining the facts governing any work, committees made up of those skilled in the subject under consideration.

The reasons governing any award shall be entered on the records of the Board of Government, and the medal will be accompanied by a suitable diploma executed by the President and Secretary, setting forth the award and the causes for which it was made.

The dies for the medal have been made by the Gorham Man-

ufacturing Company, and the design is based upon the general lines of the corporate seal of the Association.

The obverse bears the name of the Association and the dates of its foundation and incorporation. In the middle is a loom of the pattern in general use at the time of the foundation of this Association, surrounded by a garland of cotton bolls, those on the right being sea island cotton, and on the left, upland cotton. The name of the Association in mural text is girted by a polygon of hanks of yarn knotted together.

The reverse of the model bears a chaplet of oak and laurel leaves, symbolizing strength and honor, and secured at the base by an American eagle with outstretched wings, the whole forming a frame for the tablet containing the inscription of the name of the recipient, and the cause of the award.

Any suggestions of the names and work of persons thought to be deserving of this recognition, will receive careful considertion if sent to the Board of Government.

At the beginning of the year the membership was 523, and 42 have been elected during the year, and the roll of membership has been diminished by the death of Mr. GEORGE M. FULLER, who had rounded out a successful business career; Mr. WILLIAM B. MUNROE, who was a thorough manufacturer; and Captain H. S. CHADWICK, whose untimely death followed his patriotic service in the late war, for which he relinquished his business responsibilities to enter the army.

The resignations of five, and also the dropping of eight for non-payment of dues and five by the non-confirmation of election by admission fees, reduces membership which is more than balanced by the election of persons proposed at this meeting will increase the membership to 564 on April 27, 1899.

The following diagram represents in graphical form the membership of the Association from its establishment.

This chart is plotted from the following tabulation of the membership of the Association from its foundation to the present time.

MEMBERSHIP OF THE ASSOCIATION.

Number of Meeting.	DATE OF MEETING.	Membership.	Number of Present Members	Number Elected to Membership.
1	Apr. 20, 1865,	44	7	—
	July 19, 1865, Adj. Meeting,	—	1	—
2	July 18, 1866,	72	2	—
3	July 17, 1867,	—	1	10
4	Jan. 16, 1868,	108	4	14
5	July 15, 1868,	—	0	11
	Oct. 21, 1868, Adj. Meeting,	—	1	6
6	Apr. 21, 1869,	—	2	20
7	Oct. 20, 1869,	—	2	8
8	Apr. 20, 1870,	144	0	9
9	Oct. 19, 1870,	—	1	5
10	Apr. 19, 1871,	—	3	9
11	Oct. 18, 1871,	—	2	16
12	Apr. 17, 1872,	166	4	27
13	Oct. 16, 1872,	—	3	12
14	Apr. 16, 1873,	175	1	13
15	Oct. 15, 1873,	—	3	19
16	Apr. 15, 1874,	189	1	12
17	Oct. 21, 1874,	—	0	7
18	Apr. 21, 1875,	199	5	13
19	Oct. 27, 1875,	—	2	18
20	Apr. 26, 1876,	200	1	13
21	Oct. 25, 1876,	—	3	14
22	Apr. 25, 1877,	213	4	20
23	Oct. 31, 1877,	—	3	12
24	Apr. 24, 1878,	210	6	6
25	Oct. 30. 1878,	—	4	12
26	Apr. 30, 1879,	205	5	10
27	Oct. 29, 1879,	—	7	17
28	Apr. 28, 1880,	219	2	16
29	Oct. 27, 1880,	—	3	13
30	Apr. 27, 1881,	231	3	12
31	Nov. 30, 1881,	—	2	5
32	Apr. 26, 1882,	231	2	9
33	Oct. 25, 1882.	—	3	7
34	Apr. 25, 1883,	240	5	15
35	Oct. 31, 1883,	—	4	10
36	Apr. 30, 1884,	247	4	9
37	Oct. 29, 1884,	—	2	3
38	Apr. 29, 1885,	225	3	3
39	Oct. 28, 1885,	—	7	8
40	Apr. 28, 1886,	225	4	7
41	Oct. 27, 1886,	—	7	8

Number of Meeting.	DATE OF MEETING.	Membership.	Number of Present Members	Number Elected to Membership.
42	Apr. 27, 1887,	234	5	13
43	Oct. 27, 1887,	—	2	3
44	Apr. 25, 1888,	241	11	15
45	Oct. 31, 1888,	—	8	13
46	Apr. 24, 1889,	242	5	6
47	Oct. 30, 1889,	—	4	9
48	Apr. 30, 1890,	246	6	7
49	Oct. 29, 1890,	—	9	11
50	Apr. 29, 1891,	254	4	4
51	Oct. 28, 1891,	—	5	8
52	Apr. 27, 1892,	244	12	12
53	Oct. 26, 1892,	—	16	19
54	Apr. 26, 1893,	259	7	10
55	Oct. 25, 1893,	—	8	9
56	Apr. 25, 1894,	270	12	14
57	Sept. 27, 1894,	292	15	21
58	Apr. 24, 1895,	383	78	94
59	Oct. 24, 1895,	422	46	48
60	Apr. 29, 1896,	450	27	30
61	Sept. 22, 1896,	459	18	19
62	Apr. 28, 1897,	495	41	44
63	Oct. 27, 1897,	523	38	39
64	Apr. 27, 1898,	535	25	24
65	Sept. 29, 1898,	554	17	18
66	Apr. 26, 1899,	564	34	34

There have been several contributions to the library during the year, but it is far from being the full collection of books on textile subjects which is anticipated for the future, and it is hoped that members will send to the Association headquarters any such contributions as they consider may be of interest and value in such a library. A large number of members and other visitors call at the office for the purpose of consulting the bound volumes of the Transactions of the Association, and the technical papers and reports of other societies which are kept on file.

The Transactions of the following societies are sent to the Association:

TRANSACTIONS OF TECHNICAL SOCIETIES.

American Society of Civil Engineers,	New York.
American Society of Mech. Engineers,	New York.
American Institution of Elect. Engineers,	New York.
Boston Chamber of Commence,	Boston.
Bnreau of the American Republic,	Washington, D. C.
Consular Reports, Bureau of Statistics,	Washington, D. C.
Gunton Institute Bulletin,	New York.
National Association of Wool M'f'rs.,	Boston.
National Electric Light Ass'n.,	New York.
Western Society of Engineers,	Chicago.

LIST OF PERIODICALS KEPT OE FILE.

American Wool and Cotton Reporter,	Boston.
Boston Journal of Commerce,	Boston.
Cassier's Magazine,	New York.
Dry Goods Economist,	New York.
Electrical Review,	New York.
Engineers' and Power Users' Magazine,	Boston.
Engineering Record,	New York.
Fibre and Fabric,	Boston.
Home Market Bulletin,	Boston.
Iron Age,	New York.
Manufacturers' Record,	Baltimore.
Mill and Shop,	Boston.
Power,	New York.
Textile America,	New York.
Textile Recorder,	Manchester, England.
Textile Record of America,	Philadelphia.
Textile World,	Boston.

Respectfully submitted,

C. J. H. WOODBURY,

Secretary and Treasurer.

On motion of Mr. WALTER E. PARKER, duly seconded, the report of the Secretary and Treasurer was accepted and ordered placed on file.

The PRESIDENT. I want to say just a word in regard to the causes which have led to the adoption of the medal. Mr. WOODBURY would be more competent to explain the matter than myself. I learn that it is the custom of many of the industrial institutions of our line to present such medals in recognition of worthy inventions, worthy acts, anything that promotes the especial object for which the Association is organized. I have been heartily in favor of the adoption by us of such a system, inasmuch as our Association has grown so rapidly and we have many young people coming into it, to whom it will be an inducement for the presentation of better papers, as well as an inducement for inventors and for all who are interested in the New England Cotton Manufacturers' Association to do all in their power to increase the interest and the welfare of this Association. It strikes me that he who so conducts those affairs as to be able to receive a medal as an award may well be a very proud man. The medal awarded to any person by a body as large and intelligent as this society represents is certainly something of very great worth. It is not its intrinsic value, but it is the fact that merit is recognized. While there was not an opportunity to lay this matter before the Association at large, it was within the jurisdiction of the Board of Government to adopt it, and they have done so within the last year and have procured the dies, so that whenever in the opinion of the Board of Government there is any matter that is worthy of the presentation of this medal, it is in their power to award it. If there are any remarks or questions that might be of interest in regard to this medal and its objects which I have explained, our Secretary will be only too glad to give information in regard to it. If there is any one who has a single question to ask I hope he will do so at this time. If there is nothing to be said in regard to that I shall take it for granted that the Association puts great confidence n the ability of the Board that adopted it.

Mr. ARTHUR H. LOWE. Mr. President, I think that this act will meet with the approval of all—I certainly hope that it will —and that it may be a matter of record as the action of the Association, I move that the approval of this Association be extended to the Board who have adopted this idea.

The motion was seconded by Mr. STEPHEN N. BOURNE.

The PRESIDENT. Gentlemen, you hear the resolution offered by Mr. LOWE, that the adoption of this medal system by the Board of Government meets with the approval of the full Association.

The motion was put to vote and carried unanimously.

The SECRETARY. The headquarters of the Boston Society of Civil Engineers are in Room 715 in this building, which is upon the mezzanine story, the height of the gallery, and through their courtesy this room is at the disposal of the members for conference, for committee meetings, for correspondence, or for any purpose.

In regard to the badges, each member of course is entitled to a member's badge, which he will receive from the young man in the entry. There are a great many here as guests, either by invitation of the Board of Government or by invitation of members, who, if they wish, can have a souvenir guest's pin. This method is adopted for one reason, that we like to obtain for the Transactions the names of all the members and all the guests who are present.

The ballot for new members will not be taken until tomorrow, as it is in the hands of the printer, and if there are any propositions for membership, if they will be handed in at some time during the morning session the names can be considered by the members of the Board of Government and transmitted to the printer by telephone.

Of the replies to invitations issued by the Board of Government, who have followed a worthy custom, we have several

which I will read: One from the president of the American Society of Mechanical Engineers, who is also the head of the Bureau of Steam Engineering of the Navy Department, Rear Admiral GEORGE W. MELVILLE, who regrets that he cannot be present and extend his compliments to the Association, and wishes it a most successful meeting. Professor F. R. HUTTON of the American Society of Mechanical Engineers desires to express on his own behalf and that of the council the thanks of the society for the invitation to meet with the New England Cotton Manufacturers' Association. Mr. C. H. HARDING, whom you remember so pleasantly not only by the acquaintance of many of us but from the active part that he took in the Philadelphia meeting, extends his regrets that he cannot be in Boston at this time. Mr. T. C. SEARCH, also of Philadelphia, acknowledges with pleasure the courtesy done in sending the invitation, saying, "I assure you that I should like to accept but for the pressure of such official duties as seem to make it impossible on this occasion." Mr. T. F. LEAVITT of the Pennsylvania Railroad Company, who spoke so instructively two years ago upon the transportation of cotton, regrets that he is unable to be here, as does Mr. FERDINAND W. PECK, the secretary of the United States Commission to the Paris Exposition. Mr. ELWYN PRESTON, the secretary of the Boston Chamber of Commerce, expects to be here, as does Col. ALBERT CLARK, of the Home Market Club.

The following papers were read and topical questions discussed:

Industrial Institutions; Their Organization and Regulation.

HERBERT E. WALMSLEY, New Bedford, Mass.

Discussed by Messrs. ARTHUR H. LOWE and JUSTIN A. WARE.

Depreciation.

JOSEPH NASMITH, Manchester, England.

Read by the Secretary in the absence of the author.

Discussed by Mr. WILLIAM F. SHERMAN.

Competition of Southern Mills in 1850.

Compiled by the Secretary.

TOPICAL QUESTION.

107. Are not second-hand machines quite as good for purposes of instruction in technical schools as new ones?

Discussed by Messrs. CHRISTOPHER P. BROOKS and FREDERICK A. FLATHER.

SECOND SESSION.

WEDNESDAY AFTERNOON, APRIL 26, 1899.

Meeting called to order at 2 P. M. President KNIGHT in the chair.

The following papers were read and topical questions discussed:

The Cotton Trade with Our Newly Acquired Territories.
Prof. WILLIAM P. WILSON, Sc. D.
Director Philadelphia Museums.

Read in the absence of the author by Mr. E. W. S. TINGLE of Philadelphia.

No discussion.

Methods of Cost Finding in Cotton Mills.
WILLIAM G. NICHOLS, Chester, S. C.

Discussion postponed until Autumn Meeting.

TOPICAL QUESTIONS.

108. What is the best way to keep mill hose for fire protection?

109. Are automatic sprinklers a necessity in the dust flues from pickers?

Discussed by Messrs. HENRY T. GRANT, Jr., LOUIS SIMPSON,

C. J. H. WOODBURY, JOHN E. PREST, EDWARD ATKINSON and ROBERT MCARTHUR.

Gray Goods from the Bleacher's and Finisher's Point of View.

DANIEL MOORE BATES, Jr., Wilmington, Del.

Discussed by Messrs. RUSSELL W. EATON, LOUIS SIMPSON, STEPHEN A. KNIGHT, WILLIAM P. DEMPSEY, ROBERT R. SMITH, JOHN GREGSON, ROBERT B. TREAT and STEPHEN N. BOURNE.

The Drying of Cloth.

ALFRED A HUNTING, Salem, Mass.

No discussion.

Points on Sizing, Finishing and Packing Goods.

ARTHUR PARKINSON, New York.

No discussion.

TOPICAL QUESTION.

110. Is it economical to place compound condensing engines in a mill to supplement water wheels during the periods of low water, where the times of such service are short, and fuel expensive?

Discussed by Captain JAMES G. HILL.

THIRD SESSION.

THURSDAY MORNING, APRIL 27, 1899.

Meeting called to order at 10 A. M., President KNIGHT in the chair.

The SECRETARY. The Board of Government present with their approval the following names of candidates for membership:

FOR ACTIVE MEMBERSHIP.

FREDERIC AMORY, Treasurer Nashua Mfg. Co. and Jackson Mfg. Co., 40 Water St., Boston, Mass.
By Mr. F. C. MCDUFFIE.

LOUIS B. BARKER, Agent United States Cotton Co., Central Falls, R. I.
By Mr. O. B. PARKER.

JEFFERSON BORDEN, Jr., Supt. Fall River Bleachery, Fall River, Mass.
By Mr. WM. G. NICHOLS.

HERVEY BURNHAM, Supt. Beaver Mills and Eclipse Mill, North Adams, Mass.
By Mr. JOHN T. MEATS.

FRANK H. COTTON, Supt. Hope Mills Mfg. Co., Hope Mills, N. C.
By Mr. W. C. HOUSTON.

BRADFORD C. DIVINE, Supt. and Mgr. Utica Willow Vale Bleaching Co., Chadwicks, N. Y.
By Mr. ARTHUR PARKINSON.

LEWIS DEXTER, Jr., Mgr. The Canadian Colored Cotton Mill Co. Ltd., Milltown, New Brunswick.
By Mr. CHARLES O. DEXTER.

FRANK H. DWELLY, Treas. Tecumseh Mills, Fall River, Mass.
By Mr. GEORGE H. HILLS.

ARTHUR C. FREEMAN, Supt. Finishing Dept., Boston Mfg. Co., 97 Church St., Waltham, Mass.
By Mr. CHARLES L. BAILEY.

WILLIAM J. HADFIELD, Supt. Atlantic Mills, 225 Bailey St., Lawrence, Mass.
By Mr. EBEN C. WILLEY.

EFFINGHAM C. HAIGHT, Treas. Wampanoag Mills, Fall River, Mass.
By Mr. GEORGE H. HILLS.

WILLIAM D. HARTSHORNE, Agt. Arlington Mills, Lawrence, Mass.
By Mr. F. C. MCDUFFIE.

FRANKLIN W. HOBBS, Asst. Treas. Arlington Mills, P. O. Box 3590, Boston, Mass.
By Mr. F. C. MCDUFFIE.

CHARLES M. HOLMES, Supt. Manchaug Co., Manchaug, Mass.
By Mr. HERBERT L. WALMSLEY.

GEORGE A. MOODY, Supt. Warren Cotton Mills, West Warren Mass.
By Mr. C. H. HOBBS.

JOSEPH H. POTTER, Jr., Supt. Durfee Mills, Fall River, Mass.
By Mr. GEORGE H. HILLS.

EMORY S. RATHBUN, Supt. Pequot Mills, Montville, Conn.
By Mr. JOHN ECCLES.

ROBERT STEWART, Supt. Shove Mills, Fall River, Mass.
By Mr. GEORGE H. HILLS.

JOHN SULLIVAN, Supt. Union Cotton Mills, Fall River, Mass.
By Mr. DANIEL GILLIGAN.

TIMOTHY SULLIVAN, Supt. Davol Mills, Fall River, Mass.
By Mr. GEORGE H. HILLS,

JOSEPH S. TIDD, Treas. and Agt. Oakland Mills, Taunton, Mass.
By Mr. JOHN T. MEATS.

HORACE W. TINKHAM, Treas. and Agt. Robeson Mills, Fall River, Mass.
By Mr. GEORGE H. HILLS.

ROBINSON WALMSLEY, Supt. Tecumseh Mills, Fall River, Mass.
By Mr. GEORGE H. HILLS.

J. S. WILBUR, Supt. Glasgow Yarn Mills Co., Glasgow, Conn.
By Mr. JOHN ECCLES.

JAMES M. YOUNG, Mgr. Hamilton Cotton Co., Hamilton, Province of Ontario.
By Mr. CHARLES O. DEXTER.

FOR ASSOCIATE MEMBERSHIP.

A. M. BENSON, Mfr. of Cloth Boards, 27 Kilby St., Boston, Mass.
By Mr. F. C. MCDUFFIE.

C. F. CURWEN, Treas. Dinsmore Mfg. Co., Salem, Mass.
By Mr. JAMES A. WALSH.

REDINGTON FISKE, Gen. Mgr. Planters Compress Co., 89 State St., Boston, Mass.
By Mr. C. J. H. WOODBURY.

F. A. W. HARRIS, Harris-Corliss Steam Engine Co., Providence, R. I.
By Mr. A. WALTER HARRIS.

JOHN HOGG, Smith, Hogg & Gardiner, 140 Essex St., Boston, Mass.
By Mr. C. J. H. WOODBURY.

W. C. LANGFORD, Oil Dealer, 86 Weybosset St., Providence, R. I.
By Mr. JOHN ECCLES.

ARTHUR J. WARREN, Star Harness Co., Fall River, Mass.
By Mr. J. C. SMITH.

STEPHEN M. WELD, Cotton Buyer, 89 State St., Boston, Mass.
By Mr. F. C. MCDUFFIE.

W. W. WHITE, Agent Holyoke Machine Co., Worcester, Mass.
By Mr. F. C. MCDUFFIE.

The President appointed Messrs. FREDERICK A. FLATHER, SIDNEY B. PAINE and JOHN GREGSON a committee to distribute, collect and count ballots, who reported later that they had

attended to their duties and that each of the names had received unanimous election.

The PRESIDENT. I declare that the gentlemen whose names are upon the ballot have been unanimously elected members of the New England Cotton Manufacturers' Association.

The following papers were read and topical questions discussed:

What Belting is Made Of, and Its Care.

PHILIP DANA, Westbrook, Me.

No discussion.

TOPICAL QUESTIONS.

111. What is the superiority of iron beams over those of southern pine for mill floors?

Discussed by Messrs. FRANK P. SHELDON, WOODBURY K. DANA, LOUIS SIMPSON, FREDERICK C. MCDUFFIE, STEPHEN A. KNIGHT, ARTHUR H. LOWE and EDWARD ATKINSON.

112. What is the best method of coloring the inside walls of mills?

Discussed by Messrs. STEPHEN A. KNIGHT, EDWARD ATKINSON, ARTHUR H. LOWE, LOUIS SIMPSON and an absent member whose name was withheld at his own request.

Mr. WALTER E. PARKER, for the committee on nomination of officers, submitted the following report:

April 27, 1899.

REPORT OF COMMITTEE ON NOMINATIONS.

To the Members of the New England Cotton Manufacturers' Association:

The Committee on nomination of officers to fill vacancies expiring by limitation have attended to their duty and report their nominations as follows:

President,

FREDERICK E. CLARKE.

Vice-Presidents,

FRED C. MCDUFFIE, HENRY T. WHITIN.

Directors,

A. TENNY WHITE, ALFRED E. ADAMS.

Respectfully submitted,

W. E. PARKER,
S. S. SPENCER,
ROBERT MCARTHUR,
ARTHUR H. LOWE,
Committee on Nominations.

The President appointed Messrs. CHARLES L. BAILEY, PHILIP DANA and WILLIAM L. LYALL a committee to distribute, collect and count ballots for the election of officers to fill vacancies expiring by limitation, and the committee proceeded to the discharge of their duties, the President announcing that the result of the ballot would be declared at the afternoon session.

TOPICAL QUESTION.

113. How can a card room be ventilated without undesirable currents of air?

Discussed by Messrs. EDWARD ATKINSON, LOUIS SIMPSON, STEPHEN N. BOURNE, STEPHEN A. KNIGHT, FRANK A. BOWEN, JOHN ECCLES and C. J. H. WOODBURY.

Auxiliary Power Plants with Electric Transmission at Grosvenor Dale and Lyman Mills.

FRANK P. SHELDON, Providence, R. I.

The Advantages of the Electric Driven Cotton Mill.

W. B. SMITH WHALEY, Columbia, S. C.

Fallacies Concerning the Electric Drive.

SIDNEY B. PAINE, Boston, Mass.

Discussed by Mr. JOHN E. PREST, Professor CHANNING

WHITAKER, Messrs. CHARLES W. DENNETT, ARTHUR H. LOWE, C. J. H. WOODBURY, LOUIS SIMPSON, FREDERICK A. FLATHER, JOHN ECCLES, STEPHEN A. KNIGHT, SIDNEY B. PAINE, W. B. SMITH WHALEY and EDWARD W. THOMAS.

TOPICAL QUESTIONS.

114. What are the relative merits of arc and incandescent lights for weave rooms?

Discussed by Mr. SIDNEY B. PAINE.

115. How far is it practicable to substitute frames for mules in spinning filling?

Discussed by Mr. ARNOLD B. SANFORD.

FOURTH SESSION.

THURSDAY AFTERNOON, APRIL 27, 1899.

Meeting called to order at 2 P. M., President KNIGHT in the chair.

The discussion of the general topic of electrically driven mills, begun at the morning session, was continued by Messrs. RUSSELL W. EATON and SIDNEY B. PAINE.

TOPICAL QUESTION.

116. Have the methods of sampling round bales proven satisfactory in practice?

Discussed by Messrs. JOSHUA GARSED, D. C. BALL, STEPHEN A. KNIGHT, LOUIS SIMPSON, ROBERT MCARTHUR, EDWARD ATKINSON, ARTHUR H. LOWE and WILLIAM C. LOVERING.

The following papers were read:

The Fibre of Cotton.

EDWARD ATKINSON, Boston, Mass.

Discussed by Professor CHARLES L. NORTON, Messrs. LOUIS SIMPSON, ALFRED M. GOODALE, ALFRED E. ADAMS, ROBERT R. SMITH and FRED C. MCDUFFIE.

Roller Ginning.

EDWARD W. ATKINSON, Boston, Mass.

Discussed by Mr. R. DERDEYN, Vicksburg, Miss.

The Automatic Conveying of Cotton from Storehouse to Picker Room.

EDWARD W. THOMAS, Lowell, Mass.

Consideration of the following topical questions was postposed to a future meeting:

114. What are the relative merits of arc and incandescent lights for weave rooms?

115. How far is it practicable to substitute frames for mules in spinning filling?

The PRESIDENT. The next thing in order will be to call upon the committee who distributed and collected the ballots for the election of officers to give us their report.

BALLOT FOR OFFICERS OF THE NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION.

Total number of ballots cast,		79
Necessary for a choice,		40
For President,	FREDERICK E. CLARKE,	79
For Vice-Presidents,	FRED C. MCDUFFIE,	79
	HENRY T. WHITIN,	79
For Directors,	A. TENNY WHITE,	79
	ALFRED E. ADAMS,	79

C. L. BAILEY,
PHILIP DANA,
WILLIAM L. LYALL, } *Tellers.*

The PRESIDENT. I declare the gentlemen named in this report as elected officers of this Association for the ensuing year.

It has been the custom for years past for the retiring President to extend the hand of fellowship, and words of greeting and welcome to the incoming president; but Mr. CLARKE, who has been elected your president for the coming year, is in Missouri,

I think, at any rate, out of Boston and not able to be here to-night. I bespeak for Mr. CLARKE the hearty co-operation of the whole Association. I am somewhat acquainted with him and know him to be a gentlemen of ability, pleasing in manners and an excellent presiding officer. He will do credit to the position and please the Association, and I am very happy to announce his election.

Mr. ALFRED M. GOODALE. Mr. President, may I say just one word before the meeting closes? I think that the matter which Mr. NORTON has brought before the Association today and the instruments which he had exhibited are by far one of the most interesting and important things which the Association has considered for a long time. The investigation has only just begun; he has only worked on the outer edges of it. In talking with Professor NORTON yesterday he told me that it was perfectly feasible in continuing his investigations of the cotton fibre, fibre by fibre, to make micro-photographs of the fibres at the time he is testing, so that we shall have, if the investigation is continued, a photograph in large size of the convolutions of the fibre after each one of the processes of manufacture. If the Association would appropriate or authorize the Board of Government to appropriate a small amount of money for that purpose, I think we could have a most interesting and valuable paper at the next meeting.

The PRESIDENT. The matter is open for discussion.

Mr. ALFRED E. ADAMS. I heartily concur with Mr. GOODALE'S suggestion, and I move that the Board of Government be authorized to expend a sum of money to continue these investigations.

Mr. EDWARD ATKINSON. I want to say, gentlemen, that this subject has taken possession of Mr. NORTON instead of his taking possession of it. He has not received one cent. He has devoted himself to it, and I have put up the money and got him

to advance. That ought not to be the way. I can do it and get the money, but this is too big a thing for any one or two individuals to take care of. I think the Association might take part in it, I hope they will.

Mr. ROBERT R. SMITH. I move, Mr. President, that sufficient money be appropriated from the treasury to reimburse Mr. ATKINSON—

Mr. EDWARD ATKINSON. Leave it to the Board of Government.

Mr. ROBERT R. SMITH. That is what I meant. I move that the Board of Government be recommended to reimburse Mr. ATKINSON, and also Mr. NORTON for his services thus far rendered and go further in the matter. [Applause.]

The motion was seconded.

Mr. FRED C. MCDUFFIE. I would like to ask, Mr. President, if it is the idea of the gentleman who made that motion that no limit should be fixed to the amount of money to be expended. Does he mean to make it absolutely without limit?

Mr. ROBERT R. SMITH. I think we have reason to have sufficient confidence in our Board of Government to be sure that they would not go to any extraordinary limit.

Mr. FRED C. MCDUFFIE. It seems to me, Mr. President—

Mr. LOUIS SIMPSON. Mr. President, I would suggest, to put it in a rather different way, that the Board of Government be authorized to expend for this purpose such sums of money as it may be thought wise in their opinion to expend; because otherwise the Board of Government would be entirely in the hands of our friends; whatever they spent they would have to pay them for. We can leave it, I think, very well to the discretion of the Board of Government, but I would frame the motion so

that it will be left in their discretion entirely, and if our friend, Mr. ROBERT R. SMITH, will make the motion in that form I will be glad to second it. It is almost the same, but not quite.

Mr. ROBERT R. SMITH. Very well.

Mr. EDWARD ATKINSON. I would like to add to that a suggestion that the Board of Government appoint a sub-committee, if they see fit, to supervise the work. I called Mr. GOODALE and Mr. HERBERT LYMAN to my assistance in order that I might not be misled by my own enthusiasm, and the Board of Government might continue that committee, making the appropriation of the money at their discretion, as that committee, or appoint another, as they might desire.

The PRESIDENT. Do you make that as an addition to the motion already made?

Mr. EDWARD ATKINSON. That the Board of Government may delegate the supervision of the spending of this money to a committee to be appointed by themselves.

The PRESIDENT. Is that acceptable to you?

Mr. LOUIS SIMPSON. I think, Mr. President, that it would be better for us to pass the first motion and then to pass the other. I think it would be more polite to these gentlemen, who have done so much in this matter.

Mr. EDWARD ATKINSON. Certainly. I will make my motion if you will put the first.

The PRESIDENT. Mr. SIMPSON'S motion is that Mr. SMITH'S motion be amended so that the matter be left to the discretion of the Board of Government.

Mr. ROBERT R. SMITH. I accept the correction, certainly.

The PRESIDENT. The motion is, gentlemen, that the Board of Government be authorized to appropriate a sufficient amount of money, in their judgment, such as they see fit or deem necessary for the experiments now being prosecuted.

The motion, being duly seconded, was put to vote and carried unanimously.

Mr. EDWARD ATKINSON. I now renew my motion that the Board of Government be authorized to appoint a sub-committee, either of their own number or of others, to supervise the experiments and the expenditure of the money.

The motion was seconded by Mr. JOHN E. PREST and carried unanimously.

The PRESIDENT. Is there anything further before our meeting should be adjourned. Some of our papers have not been as fully discussed as we could wish, but I am aware that many of the trains leave the city at such an hour that many members who wish to avail themselves of early trains must soon leave. The discussion of a part of these subjects, I hope, will be continued at our next meeting or some future meeting. The subject of electricity and the subject of baling and other matters which have come up today are of great importance to this Association, and I have no doubt that the incoming Board of Government will take such measures as to bring these subjects before the Association at another time. In view of all these facts, and in view of the fact that our newly elected president is not with us to declare, as is customary, the adjournment of the meeting, on his behalf I now declare this meeting adjourned.

Adjourned.

Attest:

C. J. H. WOODBURY,

Secretary.

TRANSACTIONS.

FIRST SESSION.

WEDNESDAY MORNING, APRIL 26, 1899.

The Association met in Chipman Hall at 11 A. M., President KNIGHT in the chair.

The following paper was read:

INDUSTRIAL INSTITUTIONS: THEIR ORGANIZATION AND REGULATION.

HERBERT E. WALMSLEY, New Bedford, Mass.

In deciding upon what I have conceived to be an appropriate and acceptable subject upon which to address this meeting I have encountered very considerable difficulty, for in looking back over the Transactions I find so many able and exhaustive papers have been already presented, upon perhaps every conceivable topic connected with the factory proper, and the manufacture of cotton in particular, that it has seemed to me almost impossible to treat upon any question not already pretty thoroughly threshed out; nevertheless I trust that the subject I have finally chosen, with the approval of the Board of Government, may be of some interest and perchance benefit, if not to the older and more experienced members of the Association, to at least others who may not yet have had equal opportunities and advantages.

To proceed: Our great hives of industry may be likened to a highly complex organism, composed of a vast number of individual parts or powers so organized and disciplined as to act together and be mutually reliant; the vitality and effectiveness of the organism as a whole depending on the spirit of order and discipline which bring into harmonious working its component parts.

In industrial organizations, as in all other organizations, social, militant, ecclesiastical, professional, governmental, we find that each kind of work is done by those who are best fitted by nature, training and experience for the functions they severally dis-

charge; there will always be some having special aptitudes for particular arts or branches of industry.

The ideal manufacturer in his role of employer must be a natural leader of men. True indeed it is, that "the greatest study of mankind is man". No man can find himself in a position so trying and exacting as that in which he is called upon to control and direct his fellows; no position which more greatly calls for the exercise of tact, consideration and sound judgment. He must have a power of first choosing his assistants rightly, and then trusting them fully; of interesting them in the business and of getting them to trust him, so as to bring out whatever enterprise and power of organization there is in them; while he himself exercises a general control over everything and preserves order in the main plan of the business.

The abilities required to make an ideal employer are so great and so numerous that very few persons can exibit them all in a very high degree. Their relative importance, however, varies with the nature of the industry and the size of the business; and while one manufacturer excels in one set of qualities, another excels in another; scarcely any two owe their success to exactly the same combination of advantages; but in all will be found some measure of the broad faculties of judgment, promptness, resource, or steadfastness of purpose.

Whilst the head of a large business can reserve most of his strength for the broadest and most fundamental problems of his trade, he must assure himself that his managers, clerks and foremen are the right men for the work and are doing their respective work well and thoroughly; beyond this, without burdening his mind with too much detail, he must nevertheless control every detail from certain given and leading points. System and regulation will enable him to do this and to keep his mind clear and fresh for thinking out the most difficult and vital problems of his business; for studying the broader movements of the markets, the yet undeveloped results of current events and for contriving how to improve the organization of the internal and external relations of his business.

In the direction and regulation of the affairs of a manufacturing or industrial corporation there is not, in my judgment, any one thing or any combination of things of more importance than thorough organization and perfect discipline; these are indeed indispensable to the success of any enterprise.

In a modified and acceptable form, military organization has ever appealed to me as the correct system to practice in any industrial establishment employing an army of workers. Organization enables the leader of an army to transmit his orders to three or four subordinate commanders, who pass them on to others under them, until through a regular chain of responsibility the original impulse is communicated to the private soldier. The commander-in-chief is the presiding genius to whom is intrusted the supreme direction of the operations as a whole. He alone directs the order of battle, receives reports and issues orders to the generals in immediate command, with such skill and foresight that from first to last no movement fails of its object.

That warlike operations may be conducted to a successful issue, certain conditions must be fulfilled; these conditions above all others are unity of direction and the perfection of the military machine. So it should be in industrial organizations, and in addressing sensible, reasonable and practical men it is not, I take it, necessary to say that strict discipline can be maintained without recourse to the court martial.

Perfect system and a strict, whilst not too rigorous discipline, combined with well regulated order and method, constitute true organization from which alone is evolved effective and successful administration.

The very pronounced tendency of the present time being so unmistakably in the direction of centralization and amalgamation of many interests, administration and organization of the highest order and commensurate with these vast aggregations of capital and labor, have become an absolute necessity and without which it would simply be an impossibility to successfully carry on these gigantic undertakings conceived with such consummate skill and daring by the master minds of their originators.

It is plainly apparent in this comparatively new industrial evolution that system and organization of the most perfect and elaborate order must play a very leading part, and far more so than has hitherto been requisite in handling the lesser interests controlled and managed by our predecessors in the industrial world.

The chief advantages of production on a large scale are economy of skill, economy of machinery, and economy of materials. A large business buys in great quantities and therefore cheaply, and can secure men with exceptional natural abilities.

The executive officers of any institution, more especially one in which a large number of people are employed, must administer its affairs in such a manner as to impress upon every one employed the absolute necessity of harmonious co-operation and discipline. A perfect organization contributes to the pride of all, and beyond the point reached there can not be further perfection without further organization. This naturally and necessarily demands concentrated and untiring effort, with set and deliberate determination to bring out the best powers of all. The best and most nearly perfect conditions attainable are when each and every one conscientiously contributes his individual part so as to produce the most telling and effective whole; no one part should be wanting or favored at the expense of any other; there must be no weak link in the chain. A standard must be established to which every one and everything must be deliberately brought and rigorously held; an example must be set to which all must conform.

Perhaps the most striking feature of modern industrialism is that whenever individuals join their actions for a common end, some division of labor spontaneously arises. This division of labor has been carried to an extraordinary degree of completeness; 100 people working in combination produce far more than a hundred times what the most competent workman could produce by himself. This division of labor, by the concentration it induces, increases the skill of the worker and the likelihood of invention and improvement in mechanical appliances.

The productiveness of labor in which we are all so deeply concerned, and to which end all our efforts are directed, depends on (1st) the personal qualities of the workers, and (2nd) the organization of their labor. For this increased productiveness the main reliance must be placed on the development of industrial qualities, viz.: energy, intelligence and integrity. Not always, it would appear, do the workers themselves thoroughly realize and comprehend the complex arrangements which are necessary to the success of the industries in which they are engaged, or of the close and one may say delicate interdependance of businesses with their endlessly ramifying connections,—the whole constituting a veritable "organization of labor" built up and moulded by that irresistable and unerring force, the social instinct!

As illustrative of this extreme complexity of industrial operations and the immense difficulty which hence arises of counting on special results, let us enumerate the factors determining one single phenomenon as the price of a commodity, say, cotton.

A manufacturer of cotton goods has to decide whether he will increase his stock of raw material at its current price. Before doing this he must inform himself on the following points: whether the stocks of cloth in the hands of manufacturers and wholesale dealers are large or small; whether by recent prices retailers have been led to lay in stocks or not. Having formed some idea of the probable demand for cloth he has to ask what other manufacturers have done and are doing as buyers of cotton, whether they have been waiting for the price to fall or have been buying in anticipation of a rise. From different sources he has to judge what is the state of speculation, whether the stocks of the raw material are large or small, and whether many or few cargos are on the water; the stocks and prices at all cotton centres throughout the world have also to be taken note of. And then there come questions respecting forthcoming crops in the Southern states, Egypt and elsewhere.

Here are sufficiently numerous factors, but these are by no means all. The consumption of cloth and therefore the con-

sumption of cotton, and therefore the price of cotton, depends in part on the supplies and prices of other textile fabrics. If, as happened during the American Civil War, cloth rises in price because its raw material becomes scarce, linen comes into more general use, and so a further rise in price is checked. Woolen fabrics also may to some extent compete. And besides the competition caused by relative prices there is the competition caused by fashion which may or may not presently change.

Surely the factors are now all enumerated? By no means. There is the estimation of mercantile opinion, the views of buyers and sellers respecting future prices, never more than approximations to the truth, often diverging from it widely. Waves of opinion, now in excess, now in defect of the fact, rise and fall daily, and larger ones weekly and monthly, tending every now and then to run into panic, for it is among men of business as among other men that they stand hesitating until some one sets the example, and then all rush one way, like a flock of sheep after a leader.

These characteristics in human nature, leading to these irregular and violent variations, the sagacious and shrewd buyer takes into account, judging how far existing influences have made opinion deviate from the truth, and how far impending influences are likely to do so. Nor has he got to the end of the matter even when he has considered all these things. He has still to ask what are the general mercantile conditions of the country and what the immediate future of the money market will be? since the course of speculation in every commodity must be affected by the rate of discount.

See then the great complication of the causes which determine so simple and yet so important a thing as the rise or fall of a fraction of a cent per pound in cotton some months hence.

The following is a verbatim extract from Walker's *Political Economy*, (American Author,) and describes very clearly and concisely the manifold and multifarious duties that fall to the captains of industry. "Mastership is essential to a large and varied production; the master becomes a necessity of the situa-

tion. His work is not alone to enforce discipline through the body of laborers thus brought under one roof; not alone to organize these parts into a whole and keep every part in its place, at its proper work; not alone to furnish technical skill and exercise a general care of the vast property involved. Beyond these, and far more than these, he is called upon to assume the responsibilities of production; to decide what shall be made; after what patterns, in what quantities, at what times, to whom the product shall be sold, at what prices and on what terms of payment.

"The armies of industry can no more be raised, equipped, held together, moved and engaged without their commanders than can the armies of war. Those conditions of production which bring to the laborer the necessity of finding a master under whom he can work, bring to the man of superior abilities and acquirements the opportunity to employ his powers for the greatest economic advantage of society, and for the greatest profit to himself. In a community where division of labor has proceeded but a little way the man of intellect moves but one pair of arms; in a highly organized industrial system he moves a thousand.

"One man who has the genius to plan finds a host of helpers, each of whom can execute his schemes nearly, if not quite, as well as he himself individually could, who yet would have been wholly helpless and amazed in the presence of the exigencies, the difficulties, the dangers which only arouse the spirit of the master, stimulate his faculties and afford him the keenest zest of enjoyment."

Competition enters into every department of life, and especially into industry and commerce; every man is pitted against his fellow and the reward is proportioned to each as he excells in industry or skill. Such is the scheme of things, such the universal law according to which have grown and developed not only man himself but the institutions he has called into being.

It behoves each and every member, whatever his place in the

industrial order, to seek to improve his condition by all legitimate means. He sees around him men who have risen from the ranks of labor to become the conductors of industries; no one hindering them; all applauding their efforts and rejoicing in their success. He knows that for himself and his children the way is open clear up to the top. In the words of the old Anglo-Saxon bard of twelve hundred years ago, "Each of us must abide his end, let him who can work high deeds ere he die."

Time presses and we must now, therefore, strictly confine ourselves to a consideration of some of the more leading questions in the management and administration of cotton manufacturing establishments in particular, and in which so many of us are so deeply interested.

The older we get the more we realize the value and necessity of sound and thorough training in fitting a man for a position of responsibility in any walk of life. Experience and technical knowledge of the business, whatever the business may be, are necessary. I believe that the hands have had more to do in moulding the brain than the brain in moulding the hands; manual training develops the brain, upon which depends all intellectual operations.

Legitimate ambition is always to be commended and encouraged, but it is to be regretted that some men do not seem to realize that they should serve quite an apprenticeship as it were, before they are fitted or entitled to hold the positions to which they aspire. A mere superficial knowledge gained after spending a comparatively short time only at the business is not sufficient; undue haste and imperfect knowledge cannot but result in disappointment and disaster, and can only be characterized as ill-advised and unfortunate. Promotion is necessarily slow, and we all know from actual experience how discouraging and almost disheartening this is at times; then, again, there are what seem to be almost insurmountable barriers to advancement; perseverance and determination, however, ultimately triumph.

The question was asked of Demosthenes what was the chief part of an orator. He answered, "Action!" What next? "Action!" What next? Again, "Action!" If we were asked what was the chief part of a mill man we should answer first application; what second and third, again application, and it might be added application of so thorough a nature as to resolve itself into plod and continue to plod until that very application and plod become so dogged and determined that the very persistency thereof commands emulation on the part of the operatives and recognition at the hands of those in authority.

It is a fact which many of us only too well know and regret that capable and fit men are hard to find. In the keen and cruel competition of today capable and thorough men are needed more than ever, and for such there are better opportunities and brighter prospects as time goes on; in the struggle for existence there is no room with the crowd, but for any one so inclined and determined there is always room at the top. It is the young and unknown men of today who must tomorrow take the places of the old and tried men of yesterday.

Competition and pride are constantly leading to improvements of every kind, and it is one of the foremost duties of everyone holding any position of responsibility in the mill to so guide and train the help that they will be brought to take an intelligent and zealous interest in their work, become more and more economical with materials, more efficient and industrious. They should likewise be brought to realize what effect individual effort has upon the cost of production and quality of work produced. United, untiring effort should be bent in the direction of improving the quality, increasing the output, and lessening the cost; each and every one should understand that there is both personal and joint responsibility in the regulation and order of those things.

Great discretion and good judgment must be exercised in handling and controlling the operatives, and above all, justice in every sense of the word must be meeted out to them. Unless

unwisely influenced, my own experience of them as a body is that they are not unreasonable, and if we expect of them, efficient and faithful work, we must at least be prepared to be fair, just and honorable in all and every one of our dealings with them. These few words convey much; more need not be said to thinking men.

The superintendent's place is in the mill and not in the office —supervising generally and giving his undivided attention to the work and to everything that is going on in the mill; also in conscientiously seeing to it that the orders and instructions of the general manager are lived up to and carried out to the very letter.

The overseer's place is in his room, moving around all the time attending to his various duties and setting an example to the help in his particularity and thoroughness, for upon the united untiring effort and example of both superintendent and overseer depends the degree of attention employed by the operatives.

Every employee must subscribe and give obedience to the rules and regulations of the establishment, and the superintendent or overseer who through his own individual effort and example can put into practical and successful operation a system of governing the operatives whereby faithful and intelligent service is secured, becomes himself an invaluable factor of the situation.

The treatment of subordinates is one of the most important points in the entire system of a correct discipline. If we demand and expect loyalty and a faithful performance of duty on the part of our lieutenants, we must in turn recognize, support and back them up to the fullest possible extent; there must be no misunderstanding as to what is due their position and office; proper respect must be shown to all in authority.

The general manager should keep in close touch with the superintendents, the superintendents with the overseers, and the overseers with the operatives; each realizing his own responsibility and holding to strict accountability the other. In this

way alone should each one govern his conduct and his actions in the performance of his daily duty; otherwise there will most surely be friction, dissatisfaction and discontent, with consequent demoralization of the entire system.

Next, as to the quality of the product, either yarn or cloth or both. It is my firm and unalterable conviction that the one and only policy to pursue is to make as superior and high class a fabric as skill and ingenuity can devise. In my judgment it matters not whether the mill be old or new; whether the product be coarse or fine, plain or fancy; whether the times be good or bad; whether competition be keen or otherwise; under all and every conceivable circumstance and conditions the quality of the goods should be as nearly perfect as it is possible to make them. This is a principle that to my mind admits of no argument.

I would go still further by saying that the keener the competition, and no matter how bad trade may be, the necessity thereby becomes all the greater to secure still greater excellency and perfection. Furthermore, I would set my face unequivocally against any idea or suggestion that such and such styles being very particular goods for some very particular and critical party, extra special care and attention should be bestowed in the making of them. Equally on the other hand would I refuse to entertain the suggestion that some other style not being so very particular or for such very particular parties, no special care or attention is called for. I admit of no distinction in either case; all goods, as already stated, must receive equal care and particularity. The standard in all cases must be of the same high order; there must be no admission or permission to the contrary. Otherwise we strike at the very root and foundation of perfection, thereby destroying the fundamental principle of true excellency.

I will dwell a little longer on this part of my subject, and invite attention to the fact that there are today in all countries where the manufacture of cotton goods is carried on, certain well known and leading corporations who having adopted as

their trade mark "true excellence," stand out pre-eminent, having safely withstood many a storm and having successfully passed through all crises, when concerns all around them, not guided and governed by the same sound and distinctive principle, have gone under and are no longer in existance, or if in outward existance not recognizable as their former selves.

Let it not for one single moment be imagined that in attaching such supreme importance to the question of quality we lose sight of the all important question of cost. Not so; we submit that the mill recognizing as a leading principle, and adopting as its set policy a reputation for superior quality will also on the question of ultimate cost beat by all odds the mill whose sole aim and object is the production of so-called cheap goods of inferior quality.

The mill adopting this policy secures the following advantages: a general preference by the trade for its goods, with generally prices above the market; less competition with all that this implies; few or no claims; a better running mill in every particular, with less bad work and less loss all round.

In stating so positively my personal views on this question I trust it will not for a moment be thought that I wish to dictate to others their policy. Every man must work out his own salvation.

In the building and equipping of a cotton mill the very best that money, skill and experience can command, have presumably been called into requisition, and when we stop to consider the enormous amount of capital invested in manufacturing establishments and the many interests involved, there is indeed a serious responsibility attaching to the men in whose charge and to whose care these vast interests are entrusted. It is surely one of their chief duties and obligations to conscientiously see to it that the property does not suffer for the want of a legitimate and judicious expenditure in the right direction and at the right time.

We all know that there is a constant and daily depreciation and everlasting wear and tear of the mill and machinery, and it

is nothing less than a criminal dereliction of duty on the part of any responsible mill manager to allow the plant to run down or deteriorate for the want of proper repair or renewal. More especially is this unpardonable if permitted or done for the sake of making for the time being a so-called record for so-called economical management. Such mismanagement is reckless and pernicious in the extreme and should neither be countenanced or tolerated by any board of directors.

Without giving offence to anyone, may it not reasonably be asked, has there not developed in the running of some mills a mania for driving and rushing things to such an extent that almost every other consideration is lost sight of? Is not this being carried to too great an extreme in some quarters? Has it not reached the point where it is time to call a halt? The question, of course, is a very broad and leading one, and in dealing with it there are undoubtedly many things to be taken into account, but nevertheless it would seem that reason and prudence demand that some check be put upon this everlasting break-neck rush and drive. The strain and wear and tear upon everyone and everything is too severe and intense to last and cannot but result in a too early collapse of the entire system. It is difficult to see where any permanent good can result from such rushing.

A passing reference to the all-absorbing and vital question of arriving at the correct cost of manufacturing goods is all that will be attempted at this time, and that not to suggest any method whereby to compute the same, this subject on several occasions having been discussed by the Association, but only to emphasize the far reaching importance of arriving at correct figures. Above all we must avoid deceiving ourselves in this matter; everything depends upon it; it means either bankruptcy or prosperity.

We should never figure too close; if any error is made let it be on the safe and conservative side rather than in running too close to the wind. Far better to figure a little more than a fraction less. Unpleasant things are said at times and invidious

comparisons made about such and such a mill making similar goods and selling the same at less cost than we ourselves do. Myself I have always felt that a grain of individuality is worth more than a ton of imitation or doing as others do.

If any responsible manager is satisfied after careful study and thorough investigation that his figures are correct, let him stand by them, and if need be fall with them, rather than for the time being attempt to compete if he is satisfied that his figures, as applying to his individual and particular surroundings, are correct. If for any reason whatsoever he is tempted or encouraged to do otherwise or modify his figures, let him pause and reflect. Mistakes in this direction will quickly bring about financial disaster to the mill; will shortly bring about his own downfall as well as desolation on the many families depending upon the running of the mill.

It should not be forgotten, no matter how ably and skilfully the internal affairs of the mill are managed and conducted, no matter how perfect and superior the product, great trading and financial ability are equally necessary to success. One is of as much importance as the other, and whilst the two departments should and must be separate and distinct, the hearty co-operation and perfect harmony of both are indispensable; discord and faction are prejudicial to both authority and business.

In this relation I venture to bear witness to the ability generally of the traders and financial managers of the cotton industry of New England. We all know the marvelous and brilliant abilities of the Jews as traders and financiers, and we likewise know how through these channels they control and govern a large part of the commerce of the world. It has been my lot to spend many years of my life in Russia, and there I learned that in trading the Russian outwits the Hebrew; again I have in India come in contact with the Parsee merchant, and he in turn impressed me as outwitting the Russian.

For some time past it has been my fortune to be connected very closely with New Englanders, and I am now convinced that the New Englander outrivals the Parsee, hence the logical

and only conclusion that the trading and financial department of our mills may safely, and in fact had far better, be left to the treasurers, and the management and manufacturing proper to the agents and superintendents.

I feel that I have already taken up quite sufficient of the time of this meeting, and will now, therefore, only refer to one more subject, and to my way of thinking a really very important one, that is the making of contracts. Personally, I have long since arrived at the conclusion that in all business and in all dealings between men there must be a legitimate and a fair return to both; the obligation if there be any obligation, is mutual and therefore there must be mutual concession where concession is needed.

Unless we deal in and are governed by a spirit of equity there can be no true or satisfactory business. Myself I have almost invariably found that the general run of men are inclined to be fair and reasonable; to do pretty nearly what is right rather than otherwise, and that when men deal with each other on these lines and with confidence in each other's fair dealing, results generally are much more satisfactory than when both regard each other with suspicion and distrust, fearful lest either should get the better of the other.

There is one particular clause in contracts which unfortunately is perhaps oftener not fulfilled than any other part of the agreement, and that is the time limit, as understood and mutually agreed upon between the two contracting parties, and which should, in my judgment, be regarded as of equally as much importance as any other clause in the said agreement. Unless through some unusual or unforseen circumstance, such as a strike, lock-out, serious breakdown or act of God, a money forfeit on the unfulfilled portion of the contract should be insisted upon, or perhaps a more efficacious remedy would be to positively refuse to have any further business relations with the delinquent parties.

Why is it that so many contracts are not executed on time? I can only suggest two reasons: one that it was never seriously

contemplated to live up to the time limit; the other that when agreeing thereto due and proper care was not exercised in determining whether or not it could be lived up to. Unless we can rely upon the strfct fulfillment of a contract, wherein is the sence of making any contract at all? Unless we can count upon every clause and word of that contract being faithfully fulfilled, on what grounds can we base our calculations in making contracts with others? There can be no correct or reliable business on any such lax and unbusinesslike method, or rather it should be said absense of method.

There is altogether too much involved in this matter to permit of any evasion or neglect, and whilst we do not advocate going to law, it would seem that there are times when there would be justification for taking under legal advisement any such violation of agreement and which unfortunately and inexplicably is too prevalent.

As illustrative of the supreme importance of promptness and despatch in business, we should not fail to profit by the very striking object lesson recently made known through the press. I refer to a fact of world wide and far reaching significance and which has doubtless not escaped the attention of every observant man on both sides of the Atlantic, the fact that the great and enterprising Midland Railway Company of England is today buying locomotives of American make; a fact indicating the strides being accomplished by American energy and American industries; an invasion of the English stronghold, a stronghold of the very heart and centre of mechanical skill and genius; but, we rejoice, not a warlike invasion, not an invasion made terrible by enmity, but an invasion the outcome of international amity and friendly rivalry and competition.

I cannot conclude my reflections without a reference to the machinery, through the medium of which we are enabled to manufacture the fabrics which in their perfection and artistic beauty fascinate the eye, appeal to the taste and comfort, and open the purse strings of those for whom the effort has been made, inviting, as it were, the spindle and the loom to still

greater possibilities. Every credit is due the builders of the machinery for the wonderful strides they have made in placing at the disposal of the manufacturer and the operative, making the work of both easier, the wonderfully perfect and almost speakingly automatic means wherewith to accomplish the grand results achieved in the manufacture of cotton goods, in the distribution and consumption of which there has for some time past been such great depression, but which a combination of circumstances now lead us to hope that cheerfulness and prosperity are again with us.

Appreciating that the time at the disposal of these meetings is limited, I have felt constrained to be as concise and direct as possible in my remarks, and have therefore subjected to considerable revision my original notes. Very much, however, yet remains to be said, and I hope on some future occasion, if agreeable to the Association, to take up a further and much more detailed consideration of the important question of systematic and methodical management.

The PRESIDENT. I am sure the members of the Association will agree with me when I say that the paper presented to us by Mr. WALMSLEY has been very instructive, a paper of great intelligence, and a paper that will be worth our while to read when we find it on the records, to read it and re-read it until we become familiar with many of the points on which he has touched.

It has been thought by the Board of Government that at this meeting topical questions would be presented in a little different form from the practice which has been followed hitherto; that is to say, we would make topical questions very largely of the papers as they were presented; that other members, after papers had been read, would discuss the merits and demerits and the facts and all that is to be known in regard to the subjects of the papers. We shall probably pursue that course almost entirely through these papers.

I think Mr. LOWE has some comments to make on the paper just read.

Mr. ARTHUR H. LOWE. Mr. President and gentlemen, a few days ago I was invited by the Board of Government, through the Secretary, to present a brief paper upon this same subject. I certainly will not presume to discuss or criticise in any way the splendid paper which has just been presented by Mr. WALMSLEY, and I find myself much embarrassed in following it. But I have prepared a brief paper which with your indulgence I will read. It is upon an entirely different line of thought, and perhaps may be of some interest. It is made up largely of suggestions, leaving you to work out the conclusions if you are interested.

A few years ago the industrial institution as it exists today was unknown. Yarns were made on the spinning wheel, and woven into cloth on hand looms found in nearly every home. Boots and shoes were made by hand at the cobbler's bench. Paper was made by hand and dried by the atmosphere. Iron work was largely done by the "strong and sinewy arm" of the "village blacksmith" at the forge. Furniture and wood work

now done by machinery represented the handiwork of the cabinet maker and the carpenter.

With the development of water power and the invention of the steam engine the revolution began. At first the men of skill formed partnerships combining more their personal skill than capital, taking apprentices to learn the art, and usually having but few employes.

Next came the industrial institution of today, the corporation, combining both skill and capital. The present conditions of society require the corporation, at least the co-operation of skill and capital. The most successful corporations have been and will be those into which is incorporated the largest percentage of skill and integrity. We often hear that the success of a corporation depends upon its capital and labor—I contend that the success of a corporation depends upon its capital and labor and brains, and the greatest of these is brains. Capital alone is powerless. Misdirected labor with unlimited capital will make a dismal failure. All industrial institutions that succeed, whether they be co-partnerships, limited companies, or corporations, must be managed by men of integrity, ability, foresight and sagacity; the institution must command the respect and confidence of its fellow institutions with whom it must do business, and the credit of the financial institutions. The days of luck have passed, in cotton mills at least. With the organization of the ordinary corporation you are all familiar—I presume you have all, at some time, subscribed for stock in some new corporation (in some cases to regret it later), attended the first meeting, taken part in the adoption of the by-laws, elected officers: secretary, president, treasurer and board of directors, to whom is usually left the organization of departments.

This first meeting has been the only pleasant experience in the life of some corporations. But the great majority of the industrial corporations, however, of the class we are now considering, have been successful, a credit to the community where they are organized, and to the industry that they represent. They are among the most beneficent institutions of a country—

that have wrought wonders — they have developed industry, encouraged skill, brought out inventions and built communities. Next to the Church that carries consolation to the soul, stands the industrial institution, affording opportunity to labor to obtain daily bread and the necessaries and comforts to make homes happy — next to the minister of the gospel stands the paymaster of the mill.

EMERSON says:

> Give fools their gold and knaves their power,
> Let Fortune's bubbles rise and fall,
> Who herds a field or trains a flower,
> Or builds a mill is more than all.

As a general thing this class of industrial institutions is well regulated by the laws of self preservation and the laws of the states in which they are organized. I believe in a reasonable and just state regulation protecting the public, the labor and the capital. You know DAVID HARUM says, "A few fleas are good for a dog, they keep him from brooding about being a dog."

In some states there has been far too much law and legislation of the harrassing kind, notably in Massachusetts, where today I do not know of but a single cotton mill of note being built, while in other states, where more beneficent laws exist, Massachusetts capital is seeking investment in the building of many new mills and the development of the industry.

The homes and employment of labor are also threatened by this kind of legislation. These laws are supposed to regulate industrial institutions, but in reality are interfering with, and defeating their success.

The legitimate corporation regulated by proper legislation has done more than any other agent to develop, not only the industry that we represent, but to make this the greatest industrial country in the world. The present craze to combine individual institutions into great trusts with enormous capitals based upon visionary profits representing over-estimated values, the concentration of such stupendous powers and responsibilities in the

hands of few men, the crushing of individualism, the throwing out and burying alive of men of ability and enterprise, needed in the development of the great resources of this country, is to my mind a menace to the future prosperity and growth of the industries of the country, if not to the financial and political safety of the country. These great trusts are cyclones — super-charged with wind and water. Their organization is simple — the things needful are a New Jersey charter, a cheap money market and a confiding public. Their regulation is one of the greatest problems that ever confronted this country. Much regulation will surely come from the immutable laws of safe, sound and honest business principles.

The future experiences of these new industrial institutions I will not attempt to predict or forecast.

The PRESIDENT. Are there any further remarks to be made upon this paper? Mr. WALMSLEY suggested that if there were any questions to be asked he would be only too glad to answer them.

Mr. JUSTIN A. WARE. We were very much entertained by Mr. WALMSLEY'S paper; it is finely rounded and complete and covers many fine points. But it has occurred to me that he has in his paper left out one of the cardinal principles that a successful mill agent or manager must have in order to carry his mill to the highest point of perfection. On page 108 of his paper, on the sixth line, he describes the main reliances as energy, intelligence and integrity." It seems to me he should add one more qualification and that is tenacity. A mill agent must have constitutional and acquired tenacity to carry forward to a

successful issue a line of policy that is governed by energy, intelligence and integrity. His tenacity must be of a bull-dog kind, that hangs on until successful issues are reached; otherwise, his mill cannot be successful. I think Mr. WALMSLEY later on indirectly touches upon tenacity, but he does not give that qualification on page 108.

Mr. HERBERT E. WALMSLEY. Mr. President, I thought I had perhaps been a little TOO emphatic in some of my phrases. I think that I spoke very strongly on the point of determination: "Application of so thorough a nature as to resolve itself into plod, and continue to plod until that very application and plod became so dogged"—*there* is something of the bull dog—"and determined that the very persistency thereof commands emulation on the part of the operatives and recognition at the hands of those in authority." I thought that probably covered the question of tenacity, but if not, I will try better next time, sir.

The PRESIDENT. The next paper to be presented is that on "Depreciation," by Mr. JOSEPH NASMITH of Manchester, England, a very practical and eminent Englishman who has on former occasions honored the Association with valuable papers.

[The paper was read by the Secretary in the absence of the author.]

DEPRECIATION.

JOSEPH NASMITH, Manchester, England.

There is no question on which there is such divergence of opinion, alike as to what is meant by the phrase, nor, when that is agreed upon, how the operation is to be conducted, than depreciation. Volumes have been written at one time or another, and discussions without end have been commenced and finished, and yet it is barely possible to find two men who agree upon the subject. Generally speaking, depreciation has been looked upon as a subject strictly within the province of accountants and as having very little bearing upon the actual work of a mill or workshop. It has, in consequence, fallen into the category of academic discussion, which mainly centres around the point as to how it should be computed. As a matter of fact, depreciation is of more importance than this, and deserves special consideration at the hands of those practically engaged in manufacture. It is the purpose of these few remarks, therefore, to endeavor to lay down a basis which is a true one, and, although the writer cannot—as he had hoped—be present to hear it, to elicit some discussion which may be of profit.

In all modern enterprises the element of capital enters into the problem to be solved. When the earth was young, tillage of the soil was the only method of subsistence, and primeval man, like the savage of to-day, only labored in order to obtain sufficient food for his sustenance and clothing to protect him from the elements. The exercise of this labor yielded no capital until more was produced than was wanted for individual needs, and accumulation began. As society developed, the

accumulated stores of various natural products afforded a means of barter by which one individual could obtain from another something he desired to possess in exchange for some object required by his fellow. Individual barter gave way to tribal trade, tribal to national, and so the great volume of international commerce developed. In time, standards of one kind or another were set up which speedily assumed monetary form, and the accumulations of past labor and trade were gathered together in that form, and began to be specifically called capital. The flocks and herds of the nomads, however, were as much capital as the millions of an Astor, being, in those days, the accumulations which passed current between individuals.

Capital, viewed merely as accumulated wealth, is of no value unless it is employed in some way to aid in the production of articles useful or necessary to mankind, and accordingly we find that it is customary to lend this accumulated wealth for various purposes in the hope that its employment will enable labor so to handle natural products that they may be disposed of at a rate which is capable of providing for the wants of the laborer, and of yielding a surplus for the person providing the capital. These are truisms which only lead up to a consideration of the various employments of capital upon which the question of depreciation so largely depends.

There is no question that the simplest outlay in the form of capital is that which is expended in tilling the ground. At first this was merely the application of labor, as it is in some countries to-day, where the labor is that of the owner only, and there cannot be said to be any capital employed. When, however, the owner finds that he has enough accumulated profit, either in kind or money, to enable him to find employment for others beside himself, paying them a portion of the product and reserving the rest to himself, then capital enters into consideration. Gradually he acquires a stock of implements of more or less value by means of which his operations are aided, and these form his plant. If, instead of tillage, he takes to mining or quarrying, he must still use a plant of some kind in

order to conduct his operations, but in either of the cases stated, when the operations are suspended, no amount of money previously expended leaves him any asset which is of value other than that of the plant used. The earth, whether tilled, quarried, or mined, remains of equal value before and after the operation, and any loss which occurs is only that which is represented by the diminished value of the plant used during work. In other words, there is no capital value in the business except when it is being conducted.

In the case of a manufacturing concern it is obvious that the land plays a comparitively small part, as the proportion which its cost forms of the total expenditure is small. Not only is the resultant product not obtained by the manipulation of the land, but by that of the plant and machinery placed upon it. It is, therefore, necessary to deal with a new set of conditions to those existing in the case of agriculture. Instead of expending labor upon the one natural material which is common, it is necessary to use other things which can be so operated as to produce some article useful to us and capable of sale. Thus, the buildings which contain the machinery, the machinery itself, and the accessories needed form the greater part of the value, and it is chiefly in respect of these that it is necessary to take into consideration the question of providing a sum to enable them to be replaced when they are no longer able to produce the article required.

The amount thus indicated has come to be known as depreciation, and it is worth considering for a short time what this should cover. What, then, is depreciation? Primarily it is, of course, that allowance which should be made to cover the inevitable deterioration in any machine or article used, so that at the expiration of the period when it is no longer capable of economical employment a sufficient sum will be accumulated to replace it. In short, it is a payment out of revenue of a sum equal to the amount of capital absorbed in earning the revenue. In a sense this is a reserve fund, and should be treated exactly in the same way as the latter—that is, the amount set aside

should be rigidly reserved, in order that it will be available for the purchase of the machines or articles which need replacement at the period when that is needed. It is a common practice to deal with the allowance made for depreciation merely as a matter of account; but it is only a sham unless the actual sum so accumulated is at the termination of the predetermined time available either in cash or kind—preferably the former. A reserve fund is thus created, which differs from that ordinarily known by that name only because it is ear-marked and set aside for a specific purpose, the ordinary fund being available for any of the purposes of the business. The charge for depreciation is one which constitutes a special expenditure for a specific purpose, and must be so regarded. It diminishes the profit made to the extent of the charge, and would, if not taken into account, be reckoned as part of it. It is, therefore, in its essence, reserved profit, and as such should be tangibly represented either in cash or some other form equivalent thereto.

There are, however, other considerations of importance in the case which are more complex. Primarily, it was said, depreciation is an allowance for the natural deterioration of the machine or utensil, which means capital expended, and in this form should always be made. As to the amount of the allowance, this depends on many conditions, which will be fully considered a little later; but there is another aspect which demands special thought. The writer may be excused if, under the special circumstances, the illustrations given are confined to textile factories, although it may be truly said that the same principles underlie all cases, and only need special application. In the case of a machine it is requisite to consider that not only does it wear out, but that owing to the efforts of inventors and constructors it may become, if not obsolete, not equal to machines of a later date. It is quite clear that in some few cases where a startling invention occurs the whole value of any machine may be destroyed at one stroke; but this is an extremely rare—nay, almost unknown—occurrence. As a rule,

the work of evolution proceeds in stages, sometimes quickly, sometimes more slowly; so that the unfortunate manufacturer does not suddenly find his machinery and plant rendered obsolete and of no value. But it is obvious that, however slow, this factor is one to be reckoned with, and does undoubtedly diminish the value year by year.

As an example of what is endeavored to be enforced, take the spinning frame. The old throstle or flyer spinning machine was—although in some respects the best ever used—incapable of producing more than a given quantity of yarn per hour. In consequence, the efforts of inventors were turned to other modes of continuous spinning, and the ring frame was evolved. At first, owing to imperfections in the method of manufacture, the gain was not large, and was to some extent diminished by the comparative great power needed to drive the machine, and the frequent breakages. The great conception of SAWYER, that it was possible to obtain a point of support high up the bobbin, speedily led to improvements, and the combination of this principle with that of a self-contained spindle, which was the work of RABBETH, carried the process further. But evolution was not yet at an end, and the application of the humming-top principle to the spindle gave a further impetus to the productive capacity of the machine. Moreover, while the inventor was busy, the constructor was not idle. Grateful as we ought to be to those whose conceptions have led to the evolution of the best forms of spindle, it is certain that at least as much is due to those able constructors whose constant vigilance and effort have so improved them as to add considerably to their value and efficiency.

The instance given shows that changes take place gradually, but it is quite clear that a spinner whose mill was equipped with frames having flyers would find its value much diminished on the introduction of ring spinning, and similarly would suffer proportionate loss if, having put in machines fitted with the common ring spindle, the newer type became an operative success. Further, the diminution in value is affected not only by

the increase in the working velocity of the spindle, but also by the greater efficiency, owing to better construction, which leads to a greater continuity of work. An increased production, at all approaching the amount arising from the introduction of ring spinning, renders it imperative, in the face of competition, that the new instrument shall be adopted, and thus, unless it can be applied to existing machines—utilizing some of the parts—destroys the entire value of the latter, except that of the material.

Let it be assumed that a still further step is taken. It is common knowledge that many attempts have been made to spin yarn on the bare spindle of a ring frame. Hitherto success has not followed any of these efforts, but let it be assumed that some one solves the problem. Part of the cost of a ring mill consists of the bobbins which are perforce used. This at least would be rendered unnecessary, and the bobbins would cease to have any value in this connection. Further, let it be assumed that in order to produce cops on a continuous spinning frame a radical change is made in the character of the spindle used so as to obviate the necessity for a ring and traveller; it is clear that the value of existing machines would at once suffer diminution. Much more striking would be the effect if some change in design resulted in the capacity to spin much finer counts than is possible on a ring frame, while retaining the continuous principle. This would be little short of a revolution, and would lead to an enormous diminution in the value of mule plants.

There can be no doubt, therefore, that in considering the question of depreciation, it is essential to take into account fully not merely the deterioration arising from wear and tear, but also the decrease of value consequent upon the production of new mechanical contrivances of greater power and capacity. These considerations apply in a lesser degree to buildings, but they do apply, because a given class of machinery is best arranged in a building of specific dimensions which may not be the best under other conditions. For instance, it is customary

to provide so many cards and speed spindles for a given number of spinning spindles. It needs no demonstration that an increase in the productive capacity of any of these will affect the required number of the others, and that where a building has been designed to hold conveniently and economically the specified machinery, it will not be so well adapted under the changed conditions. It is quite true that this consideration has not so much force in the case of buildings as it has in that of machinery, but it is not entirely to be lost sight of, as will be readily admitted if a mental comparison be made between the mill building of twenty years ago and that of to-day.

Having thus laid down the principles of the subject, it will be easy to deal with their application, although there are many considerations of importance to deal with.

In the first place it is evident that the amount allowed for depreciation must always partake of the nature of an estimate. It is quite true that, in some cases, past experience will enable an approximately true estimate to be made of the loss from wear and tear, but even this is largely affected by changes in form or construction leading to superior velocities. It is, however, equally certain, that not even an approximately true estimate can be formed of the diminished value likely to arise from new inventions or improvements in construction, because that would necessarily be prophetic and not based upon any definite data. There is no doubt that an older and inferior machine at a certain value may be considered equal in productive capacity to a newer and superior one at full value, but it will be found that a full review of all the circumstances will lead to the conclusion that the value must be very low.

Having thus formulated the principle underlying the subject, it is necessary to deal now with the correct mode of estimating the amount which is required to provide for the loss of capital which follows upon the use of a machine. It is customary to fix a definite percentage of the value of the machine or building and deduct it from the value year by year, the percentage being fixed by assuming a definite life for the machine. Thus it

may be assumed that a speed frame has a life of 20 years, so that a deduction of 5 per cent. yearly from the *original* value will at the end of that term provide a fund to purchase a new machine of equal value. Such a procedure is simple, and hardly requires explanation; but while safe so far as wear is concerned, it does not meet all the conditions. Further, it may well be that although a life of twenty years may be fairly presumed for a speed frame, it is not equally safe to fix the same period in the case of a loom. In other words, while the fixing of a single rate to cover the depreciation of all machines may be convenient, it is far from being accurate, because some wear faster or tend to become less efficient more quickly than others. For instance, compare the action of a spinning frame with that of a loom. In the one the motion, although rapid, is continuous, and comparitively free from shocks; in the other, during the whole period of work, the motion is intermittent and violent. It is obvious that in the one case the conditions as to wear are favorable, while in the other they are unfavorable. Thus, the character of the machine, the work it has to do, and the care bestowed on it have a great influence on the question of depreciation, and renders it necessary to consider these factors in fixing a charge. It is also desirable that the position in which a machine is placed should be considered, as in some cases there are local circumstances, such as damp or dust, directly tending to a depreciation of the machine. It is therefore essential not only to look at the matter in bulk, but also to consider the machines in detail, in order to ascertain whether one wears out more quickly than another, so that the proper allowance may be made in each case. In a spinning mill there is not much difference in the rate of wear of the various machines, because they are all run at regular speeds and without shock; but it is clear that even in this case a drawing frame is not liable to deteriorate so rapidly as a mule or a picker.

While the working of a machine tends towards a diminution of its life, the repairs upon it from time to time tend to an increase of the latter. It is thus necessary to make some provi-

sion in the estimation of yearly value for the effect of the expenditure on repairs. It should be borne in mind that the effect on the value, measured by an increased capacity of the machine for work, does not always coincide with the money cost of repairs. More money may be spent on the latter than represents the value added to the machine, for while there is, beyond doubt, an increase in value, it may not be equal to the expenditure. The general effect of repairs is, however, to extend the life of the machine, and looked at merely from the standpoint of wear and tear, they should be charged as an offset to the depreciation in the year when they occur.

On the other hand, extensive repairs when the machine is old do not affect the question of its comparatively diminished value in view of improvements made in the design and construction of similar machines during its life. This is a factor to which it is impossible to give any definite yearly value, but it is one to be reckoned with, nevertheless. It can only be taken into account properly by adding periodically a special charge, but it is met to some extent by the decreased value of the machine arising from the operation of the regular charge.

It is urged, therefore, that there are many considerations to be taken into account in reckoning depreciation. These are:—

(1) The loss of capital by the natural wear and tear occasioned by work and by neglect or carelessness.

(2) The addition to the value at any given period which results from effective repair.

(3) The character of the work to be performed, and its effect upon the construction, operation, and amount of wear of the machine.

(4) The loss of capital caused by a decrease in the relative value owing to the introduction of superior instruments capable of more economical results.

In fixing the amount set aside for depreciation, we are at once met with a bone of contention. Shall the fixed amount be deducted yearly from the *original* or *depreciated* values. In other words, shall the life of the machine be taken as the period

during which its cost shall be provided for, or shall there be at the expiration of that time a residual value which is equivalent to an extended life? It is quite certain that every machine which is replaced has some residual value. The material of which it is composed is worth something, and to that extent the absolute wiping out of its value in a given period is unjust. Generally speaking, however, the amount is not large and may in any case be allowed for in making the calculation of the yearly allowance.

It may be fairly argued that the plan deducting equal yearly instalments tells very heavily when the machine is worn and is less effective, while the deduction of a diminishing yearly sum depreciates sufficiently at the beginning, when the machine is at its best, and less after its working value is decreased. While this is true, it is purely a matter of account; and it is only permissible to adopt the plan named when the residual value at the expiration of the fixed period is only equal to that of the material. For instance, if a machine be valued at £100, and is depreciated at 5 per cent. per annum on that amount, at the expiration of 20 years the cost is wiped out. If now the percentage be only deducted from the diminished value annually, then at the end of the time named there is still 36 per cent. of the original value remaining. Now, it is obvious that no machine is worth at the expiration of such a term 36 per cent. of its original value—at any rate, no textile machine is—so that the method of computation named is of no value. If, therefore, the allowance is to be deducted from the depreciated amount yearly, then the rate must be higher at the beginning of the term than at any later period, and must, indeed, be on a diminishing scale throughout the whole period, in order to reduce the value to its proper level. On the whole, it is better and simpler, considering the purpose of depreciation, to deduct annually a fixed sum from the original cost, so that there may be some period when the account will close.

There is one other matter which deserves special consideration, namely, the question of how to charge loose tools or

accessories. In connection with all textile machines there are always a number of accessories, such as bobbins, skewers, skips, shuttles, etc., which, while not being part of the machine, are yet essential to its working. It is idle to charge these to capital as plant, and wherever this is done the account will not be kept properly. They wear out much more quickly, and require renewing more frequently, than the machines in connection with which they are to be employed. So that, if they are treated as plant, they require a much greater amount written off annually. The proper way to treat them is to catalogue them at every stock taking, charging against revenue all additions made during any period, and valuing them as a special item for use in a going concern. This system has the advantages that it gives a check on the inevitable leakage which always takes place in a manufacturing concern, and provides for the renewal of all accessories out of the yearly income.

The writer is aware that there is not much new in what he has said, but the whole subject is one which is capable of many points of view. Summing up the special desiderata in the treatment of this charge, the author thinks that it is desirable to charge a definite percentage on the value of a machine every year for a term which may be fixed as the life of the machine. The length of the term should be controlled by a special consideration of the probable life of each machine, but where a set of machines are employed, the life of which is approximately equal, then the deduction can be made from all at the same rate.

As depreciation forms a special reserve fund for a specific purpose, it should be adequate to provide for it, as it is better to err on the side of excess. It is becoming the practice in the English cotton trade to charge a definite yearly sum to depreciation, instead of a percentage, care being taken to make it adequate.

Loose plant and accessories should be charged against revenue, and not counted as plant, and care should be taken to keep them up to full value year by year.

Mr. WILLIAM F. SHERMAN. Mr. President and gentlemen, I have not prepared any paper in response to an invitation from the Secretary, but rather relied upon what might be said by Mr. NASMITH at this time to bring out perhaps a good-natured discussion of the points of depreciation, several kinds of which we all know exist and several of which are so easily figured that it is not worth while, in the absence, perhaps, of reading a paper, to spend very much time upon them. Of course the matter of calculation of the proper amount to be set aside each year for wear and tear you all are familiar with, and it is quite easily arrived at. It is not so easy to arrive at depreciation from the substitution of machines now in existence by what comes along in the nature of improvement or invention, because no man can tell what is a little way ahead of him, and it bothers many of us to tell when improvements arrive whether they are sufficiently strong to abide with us.

The PRESIDENT. As our time is somewhat limited for the morning session, we will pass on to the next subject: "Competition in Southern Mills in 1850," compiled by the Secretary.

COMPETITION OF SOUTHERN MILLS IN 1850.

Compiled by the Secretary.

The following correspondence was received by the Secretary at the hands of Right Reverend WILLIAM LAWRENCE, D. D., Bishop of the Diocese of Massachusetts.

THE GRANITEVILLE MANUFACTURING COMPANY.

GRANITEVILLE. S. C., Sept. 28, 1898.

Rt. Rev. WILLIAM LAWRENCE, D. D., Cambridge, Mass.

Dear Sir: The letter enclosed with this I found while searching amongs't the old letters, documents, etc. of the Co., for postage stamps, This one had two five cent stamps of 1847 (first issued) which I took off before I saw who the letter was from. Although a Yankee born and bred, I did not know enough about AMOS A. LAWRENCE's descendants to know who to send it to, and was about to write to my uncle, B. F. BAKER, Town Clerk of Brookline, when I saw his death noticed in the *Boston Herald.* I then wrote to Dr. WILLIAM EVERETT of Quincy, who writes me that the best place to send it to is to you, which I accordingly do. All cotton mill men of my age, 61, knew of AMOS A. LAWRENCE. I hope you will be pleased at receiving his letter.

Yours truly,

C. M. BAKER.

BOSTON, Aug. 21, 1850.

WILLIAM GREGG, Esqr., Kalmia, S. C.

Dear Sir: I take the liberty to send you a newspaper of two days since w^h^ contains an article on the cost of manufacturing at the South w^h^ may not be correct, but w^h^ will have some interest for you.

This affords me an opportunity to acknowledge the pleasure with w^h^

I read two letters from you some time since in *Hunt's Magazine*. The fairness with which you treated the subject of the relative advantages of the North and the South for manufacturing cotton, was in striking contrast to a great deal that has been written on that subject.

I hope the business of manufacturing is more successful with you than with us. At the present time we are in a sad condition. With a large stock of goods, enough for a supply of 6 m^{s}, cotton high, out of reach, labor almost as high as it has ever been, and prices of the goods low and rather declining. If it w^{d} be of any interest to you, I sh^{d} be happy to give you the figures w^{h} show the cost of manufacturing any of the different kinds of cotton goods here, or the expense of selling them. Below is a small table of seven companies in different parts of New Eng. containing about 180,000 spindles on No. 14. If you please I sh^{d} like to have the same from one or two of your mills.

	Cottn.	Labr.	Repr's and all the Expenses of manufac.	Cost per lb.
1.	12.30	4.33	2.32	18.43
2.	11.62	4.56	2.30	18.48
3.	11.46	4.64	2.44	18.54
4.	12.18	2.89	2.38	18.45
5.	11.17	3.94	2.30	17.43
6.	12.54	4.00	2.20	18.74
7.	13.65	3.92	1.74	19.31

The cott^{n} is with the waste *out*. The goods are sheetings and drillings weigh^{g} from 2.77 yds. to the lb. to 2.95.

The price of the goods is now 7½ cts. 8 m^{s} from w^{h} ½ ct. must be taken for interest, commis^{n}, etc. This cost was from Jany to July; now the cotton stands higher. These are all good mills and under good management. I think the only remedy is such a continued high price of cotton as will oblige us to stop manufacturing.

Very respectfully & truly yours,

AMOS A. LAWRENCE.

Average per diem wages earned at several concerns in the months of May, June and July.

	1	2	3	4	5	6	7	8
Picker hands	68 cents	75	81	83	83	77	88	76
Grinders	68	92	1.00	1.00	1.17	94	1.08	92
Strippers	75	70	72	72	75	73	82[2]	66⅔
Lap hands	84	75					63	66⅔
Drawing	46	48	50[2]	45	50	48	52	47.6
Roving	61	58	63	55	75	52	70	52.7
Spinners	57	56	51		75	50[2]	1.53 men	54
Spoolers	47						56	46
Warpers	66	66	63	62	62	48[8]	78	61
Dressers	76	83	88	78	83	76	1.71 men	1.04
Drawing in	65	61	67	64	60	56	98	58
Weavers	67	58	60		62[2]	63	86	67
Overseers	2.00	2.00	2.57	2.25	3.00	2.42	2.50	2.50
2nd hands	1.68	1.25	1.37[2]	1.25	1.75	1.25	1.75	1.50
3rd hands	92		1.12[2]					1.12[2]

These are not the same mills as on the other side, th° the results of those w^d^ probably vary as much as these owing to the different methods of conducting the business by different agents. The high rate of wages does not necessarily produce dear cloth. For instance, No. 3 on the list is today producing the cloth per lb. as cheap (3.85) as either of the others. Nos. 5, 6 and 7 are steam mills.

[NOTE: — One of the two letters referred to as appearing in *Hunt's Magazine* has been copied as follows from the issue of January, 1850, Volume 22, Page 107. *Secretary.*]

FREEMAN, HUNT, Esq.,
Editor of the *Merchant's Magazine.*

Dear Sir: I have read with great interest Mr. A. A. LAWRENCE'S article in your December number, and also your remarks in connection with extracts from private letters, anonymous newspaper articles, all criticising an article from the pen of Gen. C. T. JAMES, which appeared in your journal for November last.

The article referred to I read very carefully and think it will do your journal or its readers no harm, especially after what follows in the last (December) number, which every one who noticed the article so severely criticised, will read.

The able essay of Mr. LAWRENCE, although true, is in my opinion calculated to do us quite as much harm as that of Gen. JAMES. The latter's low estimates of the requisite capital, and his extravagent calculation with regard to profits, may lead a few of our unthinking capitalists into embarassment and possible loss of entire investments, which the remarks of the former are calculated to discourage the spirit of progress at present manifested in the South.

I have never encouraged persons to look for more than ten, twelve, or fourteen per cent. on investments in manufacturing, but the remuneration which capital receives when invested in such pursuits, is not a criterion from which to judge of the profits derived by a country at large.

While we admit Mr. LAWRENCE's statement relative to the dividends paid, we cannot but notice that New England has grown rich and prosperous beyond all precedent, since her capitalists engaged in this particular field of enterprise. No one can for a moment doubt that the manufacturing of cotton goods has been chiefly instrumental in producing the great changes wrought in New England during the last thirty years.

The low dividends of Mr. LAWRENCE, and the high estimates of profits by Gen. JAMES, are both calculated to mislead. Such results as those set forth in Gen. JAMES' article are utterly fallacious, for the difference between good and bad management, will dissipate even exorbitant profits. A cotton plantation in South Carolina, where the land is but tolerably productive, if well managed, will generally yield a fair interest on the capital invested. The same, badly managed, may bring the proprietor in debt. What is true of a cotton plantation, is equally so of a cotton factory. It may be truly said that, in regard to individual profits, figures do not tell the truth, but when we extend our views beyond the immediate profit to the owner, and look at the subject in a rational point of view, they may be relied upon with more safety.

The productive power of machinery adds wonderfully to the value of labor. Three hundred efficient and disciplined hands, mostly women, and many of them children, will work a sufficient number of spindles and looms to manufacture into No. 14 cloth 3,600 bales of cotton of 400 lbs. each, per annum, which under any circumstances will be worth double the cost of the raw material, and generally three times as much. By this statement it appears that three hundred hands in a factory will produce at the lowest estimate what is equivalent to twelve bales per

hand, and in prosperous times from eighteen to twenty bales, while the same number of hands, even admitting them all to be adults, would not, in South Carolina, average more than two and one-half or three and one-half bales to the hand per annum from the soil, besides raising the provisions necessary for their subsistence, estimated at not more than one bale.

Additional force is given to the argument by the fact that manufacturing labor is supplied mainly from that portion of society which cannot be rendered available in agriculture and this has peculiar force in reference to the policy of our Southern States engaging in the manufacturing of cotton, for a large portion of our poor white people are not only unproductive, but actually a burden to us. In the face of low dividends, these illustrations will show the great advantages which may be derived from the introduction of manufactures and it also explains satisfactorily how the Eastern people have grown rich from a pursuit which has paid capitalists only a moderate interest on their money. The naked statement that an individual can produce in a factory that which is equivalent to from twelve to eighteen bales of cotton per annum, would induce an inexperienced person to conclude that this business was enormously profitable, for he does not see the multitude of channels through which the large, gross profits of the manufacturer are dwindled down to very moderate ones; but it is enough for us at the South to know that manufacturing has hitherto paid sufficiently well to induce the continued annual investment of immensely large sums for thirty years past, both in the Middle and Eastern States, as well as in all parts of Europe that we have labor both white and black at least 20 per cent. cheaper than in New England, and with few exceptions, as cheap as in any part of the world,— that water power may be had for almost nothing — that our provisions are as cheap,— and above all, that we have the cotton at hand, sound, bright and unsullied by the rain, mud, smoke, etc., incident to its transit from the interior of our State to its final destination.

This last item alone, is equal to ¼ of a cent a pound in our favor, and explains what the generality of persons do not understand, why Southern manufactured domestics are superior in quality to a similar style manufactured in the Eastern States.

Fair cotton is a very different article by the time it reaches New England from what it was when it left the interior of any of the Southern States.

So far as our consumption is concerned, (which has not yet been reached by Southern production, and may not for many years to come) our advantages are too apparent to need argument. Add the transportation and charges both ways (the cotton going to the manufacturing district, and the cloth returning to us), and it makes a difference in our favor, which foreigners cannot overcome by superior skill, provided we exercise that caution in the first investment, which prudent men should do, and by such attention to the judicious direction of labor as is necessary to success on a cotton plantation.

I am very respectfully and truly yours,

WILLIAM GREGG.

CHARLESTON, S. C., Dec. 20, 1849.

The *Merchant's Magazine and Commercial Review*, to which reference has been made in the foregoing correspondence, was a magazine devoted to manufacturing and commercial interests, and was conducted with great ability by FREEMAN HUNT of New York.

An examination of the files in the Boston Public Library reveals a number of interesting articles on the subject of cotton manufacturing at the North, which was apparently on the defensive on account of the threatened Southern competition at the time.

For the convenience of any who care to examine into this question in the light of other days, the following citations are made of some of the principal articles on the subject.

The copy for December, 1849, contains on page 628, a long article on the conditions and prospects of American cotton interests, by AMOS A. LAWRENCE, in which he questions the feasibility of extensively manufacturing cotton in the South by reason of the lack of cash capital available for the business, which had not paid a satisfactory income on the investments at that time.

The tables on the dividends of New England Cotton Mills of the first class from 1839 to 1849 are given, and also the market value of the stock.

In the issue for December, 1849, page 671 contains an article from WILLIAM GREGG, founder of the Graniteville Cotton Manufacturing Company, Kalmia, S. C., upon the details of the mill, which contained 8,400 spindles, 300 looms, making sheeting, shirting and drillings of No. 14 yarn, and which was built at an investment of $300,000.

Gen. C. T. JAMES, Civil Engineer of Providence, R. I., wrote an article on cotton manufacture in the November number, page 492,

advocating cotton manufacturing in the South as furnishing the best conditions of manufacture.

Page 77, in the December issue, contains what is evidently an inspired editorial on the subject, criticising the position of Gen. JAMES, and the results of the Globe Steam Mill at Newburyport, and making declarations of the intentions of the South to enter into the cotton manufacturing business.

The January, 1850, number contains an article on the conditions and prospects of American cotton manufacture by A. A. LAWRENCE, in which he considers that the articles by Gen. JAMES were calculated to do harm and questioning especially the mills of Gen. JAMES driven by steam power.

The issue for July, 1850, page 111, contains a long article on falsely packed and unmerchantable cotton, being the report of the Committee of Arbitration of the New York Chamber of Commence.

The issue for August, 1850, contains on page 247 an account of the mills in Alabama, and also the establishment of the Coweta Manufacturing Company at Columbus, Georgia.

The issue for November, 1850, page 575, cites from the *Mobile Tribune* the following table of Southern cotton manufactories:

	S. Carolina.	Georgia.	Alabama.	Tennessee.
No. of spindles,	36,500	51,140	20,000	36,000
No. of looms.	700	1,100	550	500
Lbs. of cotton consumed,	6,000,000	10,840,000	4,400,000	5,000,000
Capital,	1,000,000	1,000,000	640,000	800,000
No. of operatives,	1,600	2,240	900	1200
No. of factories,	16	36	10	30

It was estimated that 20,000 bales were consumed in 30 mills in North Carolina.

Page 575 contains a reference to a factory on the Saluda River, near Columbia, South Carolina, operated by slave labor, with white superintendents and overseers, which is taken from the Charleston, S. C. *Mercury*, and claims that the mill was running successfully, and that this would provide a feasible means of satistactory employment of slave labor in closely settled towns, and not limiting it to sparsely settled agricultural districts.

A peculiar interest attaching to all of these contributions is their indication of the repetition of history in commercial cycles. The por-

tentious anticipations which were then contemplated by vested interests on the one hand, and the glowing expectations of prosperity under artificial conditions on the other, were set forth according to the geographical standpoint and personal interests of the various writers.

Business affairs on both the North and the South, as well as their relations, are now on an entirely different commercial basis at the present time, and the progress of the same lines of business both show that the force of skill is always a leading feature in any community.

TOPICAL QUESTION.

107. Are not second-hand machines quite as good for purposes of instruction in technical schools as new ones?

Mr. CHRISTOPHER P. BROOKS. I do not suppose that there is any intense interest in this question among the members, or that it is likely to lead to any general discussion. Second-hand machinery is certainly not as good for purposes of instruction in technical schools as new machinery, but of course the question of extent of inferiority of scond-hand machinery is a matter for debate and opinion.

The textile school is an institution in which it is proposed to educate young men to better methods of manufacturing, and instruct them how to manufacture more elaborate fabrics and to operate mills and parts of mills with increased economy and on the latest and most approved principles. This obviously cannot be done with second-hand machinery. The trustees of the New Bedford Textile School, who commenced last year to construct a textile school for their section of Bristol County, have certainly been of the opinion that new machinery was absolutely necessary. They were incorporated under the

same act that was taken advantage of in Lowell in 1895, and during the past year or so have been investigating the best methods of constructing and establishing textile schools, and have benefited by the experience derived elsewhere. A deputation of the trustees have visited the Philadelphia school and the Lowell school, and one or two of them have been abroad and visited the European schools. The result is that on the main business street of New Bedford there is now being erected for the purpose of the textile school, a three-story building which will be adequate for the cotton carding, spinning, weaving and designing departments, with an engine room and boiler house, with the usual class rooms and demonstration departments, and which is being equipped in the most satisfactory manner and with absolutely new machinery. I will not trouble you by reading the list of contributors of machinery, but I will say that the trustees of this school have benefited by the experience of other schools in three directions: they have, first of all, decided that it was absolutely necessary to be in their own building—that a building especially constructed for textile school purposes was very much better than a rented one; secondly, that the proper line to pursue is to establish a school for one branch of manufacturing, namely, cotton manufacturing, and make it perfect in every respect before dabbling in other branches; and thirdly, to obtain as wide a range of machinery as possible from different manufacturers, using duplicates and triplicates in some cases, so that the young men trained in that school shall be accustomed to all the leading makes of machinery. As a consequence, the school will be equipped with pickers from the A. T. Atherton Machine Company, with cards from the Saco & Pettee Machine Works, from the Whitin Machine Works, from the Mason Machine Works and from the Howard & Bullough American Machine Company; with drawing frames from Howard & Bullough, from Mason and from Pettee; with combing machinery both of English and American make, including Mason's and Hetherington's; with frames from the Providence Machine Company, from Howard & Bullough,

from the Woonsocket Machine and Press Company, and an English frame from Dobson & Barlow; with spinning machinery from both the Whitin and the Howard & Bullough American Machine Company; with spoolers and twisters both from T. C. Entwistle and the Draper Company; with looms from Draper, Whitin, from Crompton & Knowles, from the Mason Machine Works and Stoddard, Haserick & Richards, and several other makers, so that the equipment of machinery of that school will give a young man an opportunity to become acquainted with all the leading makes of machinery. This in itself is a sufficient answer, I think, to the question whether second-hand machines are quite as good for the purposes of instruction in technical schools as new ones. The Board of Trustees of the New Bedford school, men of business experience, have decided that second-hand machinery is not good enough and will equip their school with new machinery.

Mr. FREDERICK A. FLATHER. I would like to take exception to one matter referred to by Mr. BROOKS, from which members might draw the wrong inference. I agree that a school provided with *all* of the leading makes of machinery is best for the education of students in textile manufacturing; but there are some other makes not mentioned by him which are among leading makes.

The PRESIDENT. If there is nothing further to be said on this subject we will adjourn for dinner and convene promptly at two o'clock.

The session then adjourned till two P. M.

SECOND SESSION.

WEDNESDAY AFTERNOON, APRIL 26, 1899.

The Association met in Chipman Hall at two P. M., President KNIGHT in the chair.

The PRESIDENT. The first paper on our list this afternoon is "The Cotton Trade with our Newly Acquired Territories," by Prof. WILLIAM P. WILSON. The paper will be read in the absence of Dr. WILSON by Mr. E. W. S. TINGLE of Philadelphia.

Mr. E. W. S. TINGLE. Mr. President and gentlemen, I trust I shall not be considered presumptuous in endeavoring to fill on your programme this afternoon the place which my very much more able chief, Dr. WILSON, director of the Philadelphia Commercial Museum, expected to fill, but unfortunately, at the very last moment, greatly to his regret, he was detained by unexpected business of great importance and could not come. However, having had the pleasure of addressing the Chamber of Commerce here a couple of years ago, while I was in the consular service, upon trade openings abroad, I do not feel altogether a stranger to New England business men.

Perhaps, since Dr. WILSON'S paper containing detailed information of a more or less technical nature will be printed in full in your Transactions, I would better content myself with dwelling very briefly upon some of the leading points which Dr.

WILSON outlines, and then refer to an effort which we are now making in Philadelphia to foster export trade; an effort, I believe, that will be of interest to all of you.

The first question that arises is, what is the state of the cotton trade in our newly acquired spheres of influence, and how shall we better it? Glance for a moment at the Philippines. The Philippines have averaged for the last fifteen years an export trade of $20,000,000, an average import trade of $17,000,000, leaving them a credit balance of $3,000,000. They have imported nearly one-third of their entire imports in cotton manufactures; the exact amount being some $5,000,000. Of that amount Germany and the United States have a very small share. We will come back to that in a moment.

The population of the Philippines is about 9,000,000; a good many people to clothe, if General OTIS does not kill them all off before he gets through with them. The Spanish exports to the Philippines have, of course, comprised the lion's share, $3,500,000. That is only natural, in view of their exacting and oppressive trade regulations and the tariff regulations in favor of Spain. But Great Britain manages to get in nearly to the extent of $1,000,000 herself, Germany and the United States following along, the United States with only $94,000. This was in 1892. Evidently, then, we have a considerable opportunity of extending our trade with the Philippines, especially when, although we only sell them $94,000 worth of cotton products and only $200,000 worth altogether of the $17,000,000 which she imports, still we buy from the Philippines over $6,000,000 worth of goods. It seems that the proportion ought to be increased rather to the favor of the United States exporter, and with renewed peace and security and with renewed effort on the part of the American exporter there is every reason to believe that that amount will be increased.

In Hawaii, however, the story is rather a pleasant one. The total cotton importations last year were $360,000 of which the United States furnished over 70 per cent.,—in round numbers, $260,000; England, $70,000; Japan, $16,000 and our German

friends but $1,000 of the imports of Hawaii. But we must not allow our expectations to rise too suddenly with reference to the Hawaiian trade. They have only a population of 120,000 people, among whom are a great many Chinese and Japanese, as you know, and the demands are not likely to increase very rapidly. Still, it is a market worth cultivating, of course.

In Porto Rico and Cuba, however, there seems to be a future for the cotton trade worth developing. Their imports from Spain, according to the latest statistics, were 2,000,000 pesos (the peso being between 50 and 60 cents); from Great Britain, 1,500,000 pesos; from Germany, 23,000 pesos, and from the United States only 10,000, although Porto Rico is practically our next-door neighbor. It is reasonable to suppose, however, under new conditions, that we will get Spain's share there, too.

In Cuba there has been such disturbance of commercial conditions that no reliable statistics, either English, American or Spanish, are at hand later than 1893. There are, of course, many statistics published with reference to import and export trade in Cuba since that time, but 1893 was a more representative year in Cuba. The imports of cottons in that year amounted to near by $6,000,000, divided as follows: from Spain, $4,000,000; from England, $1,500,000; United States, but $148,000, and Germany $41,000. It is very evident that we ought to get Spain's share in Cuba now, even considered simply as the spoils of war. But with American enterprise, with renewed business activity, with settled conditions, there is every reason to expect that the figures will be reversed in the very near future, and of the $6,000,000 required the United States should furnish the $4,000,000—yes, we might say $5,500,000, allowing Spain, England and Germany the other $500,000.

Our total exports of cotton manufactures last year were about $15,000,000. With proper effort that might be doubled. With markets being opened up, with Spain and her exporters out of the way, it could be doubled. But the markets are not going to seek us. How, then, are we to double the amount? What is the proper effort, in other words?

On that point the American and the Englishman — I speak now from personal observation — might well take a leaf out of the German's book. When he seeks a new market he studies the conditions as accurately as his scientists study a new germ. He sends people to the markets in the first place, from his own house; he studies the conditions obtaining to the smallest degree. He finds out what the people want in the way of packing. He cultivates their tastes and does not try to foist his tastes upon them. He does not make the mistake of trying to do business through an interpreter; he gets a German, preferably, who can speak Spanish, when he seeks a market in a Spanish-speaking country. He forms his connections not through a native house as an agent, not through some strange and unknown quantity to him, but where possible, through a German house, and where business warrants it, establishes his own agency. He nurses and cultivates that trade, not for what he expects to get out of it this year, but for what it will bring fifteen or twenty years hence. As a German said to me, who had been very successful in cultivating trade in the Philippines, and I asked him how he did it, "The difference is this: we expect to do business fifty years from now; your people want to do business the next two or three years and get all there is out of it, and then let it go. We are content to build up our trade. Our business is handed over to our children and to their children, and we are looking to the future. We are content with the smaller profit, and never make the mistake of sending goods that are not absolutely up to sample. We never make the mistake of trying to foist our ideas upon our customers. If a man wants his cotton goods put up in sky-blue packages, he gets them."

Let me relate a case in point. A friend of mine in New York, a large cotton shipper, had built up a good trade with China. The specifications called for his packages to be wrapped, we will say, in blue paper. One day he received a very large additional order, with instructions to follow the exact packing specifications that had previously been followed. He happened to be out of

blue paper at the time and said. "What difference does it make whether I send the goods in blue or yellow paper?" He wrapped them in yellow paper, which happened to be the Imperial color in China and not one of the natives would touch them. The entire shipment was lost; it was turned back on his hands by the factor or agent in Shanghai or Hong Kong, whichever it was. So you see the absolute necessity of following specifications. A German does not make a mistake of that kind.

Another instance of this, also from New York, came under my notice. A shipper received an order from a Bolivian party, the first order he had ever had from that country, "cases to be packed not to exceed 150 pounds weight; follow specifications absolutely." He said, "What nonsense! Pack these goods in cases of 150 pounds weight? Why should I do that? I have never packed them in less than 400 or 500 pound cases; the man is silly." He sent his goods accordingly, in large cases, and the next thing he received a cable, "Goods await you on dock, refused." The goods had to be sent on mule-back two or three hundred miles into the interior; that is the reason why it was essential that they should be sent in small cases.

Instances might be multiplied of this kind, where American merchants have made like mistakes. It is only by studying the conditions as the German does and following the requirements that we can cut the German out of the market. He has already cut the Englishman out in many places, simply by studying on the ground what the people want, and then following it absolutely. There is no reason why we can't do the same thing.

We have been helping in Philadelphia, a little in that direction in the Commercial Museum. We have a commission now in South America, one in Australia, one in China and one in Europe, in addition to being in correspondence with several hundred reliable business men in these various countries, and we are furnishing all the time information to American business men unsolicited, many of whom are subscribers to the institution, and many who are not, exactly on this point regarding methods of packing and requirements of foreign markets. We

are surprised at the nature of the inquiries from business men who are carrying on businesses really of enormous extent — we are surprised to find that in many instances the first essentials in shipping goods to these various countries, the methods of packing, do not seem to be appreciated. Our men who are out in the field repeatedly write to us "Impress upon all American shippers the absolute necessity of following specifications in packing." We are now gathering photographs from all these different points illustrating methods of packing. We found the demand for information of this kind growing to such an extent that Dr. WILSON two years ago conceived the idea of an exposition which would demonstrate to the foreigner the advantage of the American manufactured product and which would show the American manufacturer what his competitor was doing, what kind of goods he was making, what markets he was supplying and what prices he was getting. With that aim in view an appropriation was secured from the general government of $300,000, from the city of Philadelphia, $200,000, and from private subscription $100,000 was raised. This sum is being devoted to the erection of buildings; the work is being pushed night and day, and on the 14th of September this exposition will open, to continue till the 30th of November. We shall display in the main building samples of American manufactured products of all kinds suitable for export. Only goods suitable for export will be displayed. It is not a show, in the amusement sense of the word; it is a business proposition, pure and simple. No exhibits will be accepted of any kind of goods whatever that are not capable of being exported. On the other hand, our commissioner now in Europe, Mr. HARPER, is expending $50,000, a sum appropriated by the general government for the purchase of samples of foreign goods, a large portion of it being spent for textiles. These samples bought by him will be displayed in an appropriate building, will be of access — not too ready access — to the general public, but of very ready access to the American manufacturer and every facility afforded him to study the samples and to compare with the samples of American manu-

factured products that are exhibited, so that he can make studies which will enable him to invade the new markets if he desires. There will also be in another department an exhibit of methods of packing collected from these different countries, so that the manufacturer can make a complete study of the question. This is an idea which was with a great deal of advantage to the British manufacturer developed several years ago by Mr. CHAMBERLAIN, then Colonial Secretary, and was done very quietly and very cleverly by him. He sent to the West Indies and procured samples of all American manufactures that were being sold in those markets. His agents were six months in picking them up. These samples were displayed in London, loaned to British manufacturers, photographed, photographs distributed, information sent confidentially with reference to American prices and American methods, and a combined effort made to shut the American out of the field.

The effect upon the American trade in the West Indies the following year was very marked. In a larger way we are going to try something of that character in this exposition. We are going to show what the foreigner is making. Above all, we are going to give the American manufacturer an opportunity to compare his product with the foreign product. We will give him also statistics as to the amount of goods sold by the foreigner and furnish him any detailed technical information of that kind that he may require. It has been very gratifying to the management of the Museum that the New England Cotton Manufacturers' Association has already shown interest in this matter. But from a purely selfish point of view it seems that they might show more interest. This is not a profit making enterprise at all. All the money is to be expended for the purpose outlined. It seems to me a movement of which the American cotton manufacturers and the makers of textile machinery, who are also a co-related branch of the business, should not lose sight. The importance of this exposition cannot be overestimated.

In connection with the exposition there is to be an international

business congress, which will take place in October. We shall have in all probability one thousand delegates from the different countries of the world, who for three weeks will be guests of the city of Philadelphia and will discuss commercial questions relating to international trade and the best way of fostering trade, the removal of tariffs, the removal of port charges, and everything of that character. We have sent out through the state department invitations to 133 foreign governments, to 400 chambers of commerce throughout the world, and are now sending invitations to 20,000 business houses in all parts of the world. These people will be entertained by the city, and the government delegates will read papers of great importance to the business world. In addition, the chambers of commerce at home, of course, will be invited. We expect the results from the congress to be of extreme importance. As you may perhaps remember, two years ago, under the auspices of the Philadelphia Museums, a Latin-American delegation visited this country — they were entertained here in Boston, among other places — and the result of that visit was really astonishing in the increased trade resulting from the connections made by those gentlemen while in this country. Well, if the 40 or 50 gentlemen who were here then brought about such results, it is fair to presume that the thousand delegates whom we have every reason to expect will be here in October, will, if their presence is properly taken advantage of, produce an enormous increase in our export trade in particular directions. It seems to me particularly to the New England Cotton Manufacturers' Association is this congress of interest. There will be men from the textile industries of Great Britain and of Germany here, and some of the greatest experts, the most prominent textile men in Germany will read papers. So that, at the risk of being thought tedious, I want to impress the fact upon your attention again, that this exposition and this congress are two things which in your own interest you cannot afford to neglect. As to the matter of space and everything of that sort, that is a detail which will be arranged to suit the requirementsof the individual exhibitor. The matter of power will

be arranged so that any one who wishes to do so may set up a live plant. All those things will be arranged to suit the exhibitor. As I said before, it is entirely altruistic; there is no intention to make money out of this exposition at all.

But, gentlemen, the detail of Dr. WILSON'S paper, the technicalities as to the kinds and sorts and sizes of weaves which can best be sold in foreign markets, will be found printed in full in the Transactions of the Association. I must content myself with giving you this sketchy outline of our purposes and the main points he mentions in his address, and simply point out to you that given a thorough study of the trade requirements on the part of the American cotton manufacturer, given proper encouragement of new steamship lines—for the trade does not follow the flag unless you have a steamship line to carry the goods—nor does the door open—the "open door" of which we have heard so much—"open wide its portals" unless you have an American steamship line to carry in competition with the German and British steamship lines; given an extension of banking facilities that will enable us to compete with the six months, twelve months and even eighteen months credit which the German allows and the Englishman allows, made easy to him because of the facilities of the great export banks of London and Hamburg; given all the facilities of that kind, and the American cotton manufacturer is a potential DEWEY in the markets of the world. Let him take the advantage that presents itself to him in these new markets and it will not be long before, in describing the relative commercial standing of nations, the same words may be used which were used with reference to the victory of a New England yacht in the first international yacht race 40 years ago, —"America first; the others not in sight." [Applause.]

THE COTTON TRADE WITH OUR NEWLY ACQUIRED TERRITORIES.

DR. WILLIAM P. WILSON, *Director of the Philadelphia Commercial Museum.*

Cotton manufactures have been in the past, and no doubt will be in the future, one of the most important items in the list of imports of the new possessions, which spheres of influence the year just elapsed has brought within the sphere of influence of the United States. They have averaged $15,000,000 yearly. We will consider Cuba, Puerto Rico, Hawaii and the Philippines, therefore, mainly in the light of new markets for our cotton products, ignoring for the present all questions of high politics.

The statistics for the year just closed show that we have exported $1,233,000,000 worth of our own products, $307,000,000 of which were manufactured goods. Last year we were for the first time the largest exporting nation in the world, the value of our exports exceeding those from Great Britain by $100,000,000.

In cotton piece goods, 25 years ago, the United States exported $1,200,000, while last year we exported $15,000,000. It will thus be seen we have already started on a war of invasion of the markets of the world. Today we are in the front rank of nations seeking entrance into the markets of the Orient.

In surveying the new possessions and possible new markets for cotton goods we will begin with the Philippines. They exceed in area New England, New York and Delaware together. Their population (9,000,000) is equal to that of New England and Ohio.

But, before coming to close quarters with the subject, it is

necessary to utter a warning note. Data concerning trade in these 1,200 islands, the home of 80 distinct tribes of marked individuality, and of mixed races born of nearly all peoples and climes, are most difficult to obtain,—that is, data absolutely reliable, or fully up-to-date. Spain has always been indifferent to the keeping of commercial records; and the political unrest of the Philippine Islands has not failed to increase this natural distaste for the work in question. The representatives of the government of Great Britain, Belgium and Germany and the special commissioner from our own government, have all endeavored to furnish reliable figures concerning trade in the Philippines. But these observers have all been forced to depend for the chief items of information largely upon local business houses. The one circumstance that, in stating the export value of a certain product,—the Belgian Consul gives it as $2,600,000 and an American authority as $4,500,000,—illustrates the difficulties under which the work of collecting such information is conducted, and emphasizes the necessity for taking as approximate, rather than exact, the statistics furnished from any source of information at present available. It is believed, however, that the facts and figures herewith presented are as nearly correct as possible.

In taking the measure of a new customer, a manufacturer would naturally ask, first, What is the extent of his resources? Second, what is his business probity; his right to that credit which must, as trade develops, be extended to him? In short, what has he, and what is he? The same rule applies to the first step in foreign trade. What have the Philippines? What are the Philippines?

In the first place, our new customers have, for generations, kept a credit balance at the world's great bank, in the shape of favorable trade balance. During the first fifteen (15) years, 1880 to 1895, their record shows a yearly average of:

		Gold.
Exports valued at		$20,566,005
Imports	" "	17,039,044
	Credit,	$3,526,961

For the year these figures are placed at,

	Gold.
Exports	$20,978,898
Imports	9,120,000
Credit bal.	$11,858,898

The Philippines have, it would appear, not only a steadily maintained credit, but a growing one; and this growth has taken place in the face of a foreign rule discouraging to production.

Analyzing this "productive capacity" of the Philippines, we find the export of the year 1898 — a fairly representative year and the latest of record — as follows:

		Gold.
Exports of hemp	valued at	$8,571,850
" " sugar	"	6,911,535
" " copra	"	2,687,978
" " leaf tobacco	"	1,323,445
" " cigars	"	804,935
" " indigo	"	80,825
" " various	"	628,330
Total Exports 1897	"	$21,008,898

This analysis of exports discloses a most important fact, viz: The exports are composed, as regards at least 75 per cent., of hemp, sugar, and copra. Now, the production of these articles named shows a steady, and in one case a marvellous, increase both as regards quantity and value, which may be seen in the following figures:

	Tons.
Hemp exported 1890	63,269
" " 1897	112.786
Sugar exported 1890	165,229
" " 1897	226,343
Copra exported 1892	350
" " 1897	56,500

These are wonderful figures and reveal the existence of a latent wealth and capacity, in land as well as people, which is an earnest of better and brighter days under firm but honest rule, stable and equable conditions in the commercial world. And these conditions and prospects are even brighter than they appear at first sight; coffee, which once provided an export value at over $4,000,000 does not show in the list of exports today. It is absent from that list, however, only because the ravages of an insect destroyed all plantations in 1891—plantations which, owing to the troubled state of the islands and distractions of native intrigue and rebellion, have not yet been put in a condition for bearing.

This loss of coffee as an export is, therefore, temporary only, and the value of coffee export must be borne in mind by all who wish to measure correctly the purchasing power of the Philippines.

But even when we add coffee to the list of exports, and, so corrected, view the past record of Philippine exports, we have come into a moderate conception of the real wealth of these Islands, and their consequent capacity to absorb a material percentage of American cotton manufacture.

Coming to the more civilized minority of the population, we find the men dressing in hats, pantaloons, shirt and slippers of the usual tropical weight and texture. The large Chinese population clings to its traditional dress. The dress of the Philippine women is more elaborate and expensive. It generally consists of a thin camisa or waist, with large flowing sleeves. A more or less highly embroidered chemise showing through the camisa; and a large panaela or kerchief folded about the neck with the ends crossed and pinned on the breast; a gaily colored skirt with long train; and a square of black cloth, the tapis, drawn tightly around the body from waist to knees. Stockings are not worn, as a rule.

The natural question, at this point is, Who supplies the demand for products from beyond the islands? The following table will throw some light on the matter, not only showing

from whom the Filipinos buy, but in what proportion and to whom they have paid the bill with *native products*.

AVERAGE ANNUAL VALUE OF MERCHANDISE IMPORTED INTO THE PHILIPPINES AND OF PRODUCTS EXPORTED TO THE SAME COUNTRIES FROM THE PHILIPPINES.

Sold to the Philippines by	1887 to 1891	1892-6	Bought from the Philippines by	1887-91	1892-6
	Annual Average			Annual Average	
United Kingdom	$5,207,006	$3,105,976		$8,729,072	$8,844,026
United States	130,662	135,228		8,785,988	6,053,232
Germany	887,343	748,177		175,961	201,158
Spain	1,638,004	5,174,002		3,814,426	3,855,165

This "supply trade" was at one time practically monopolized by Great Britain but Spain, by the aid of tariff and political pressure, has captured the bulk of the trade; in 1896 the relative position of the supplying countries stood as follows:

Spain: value of goods shipped to Philippines	$7,401,002
United Kingdom	2,576,758
Germany	744,940
United States	94,579

In 1887 the combined value of Spanish shipments of cotton fabrics and cotton yarn and thread was only $120,124. In 1896 this value had increased to $3,474,842. These figures tell their own story.

The tariff, above referred to, came into force in the year 1891. The trade in cotton goods and yarns diverted from Great Britain to Barcelona, was chiefly in "stouter makes" of piece goods and in yarns. In the case of goods made of fine yarns, such as book muslin, the trade still remains with Great Britain, Spanish manufacturers having, hitherto, failed to produce at a reasonable figure cloths made of the finer counts.

Lancashire spinnings, however, have been completely shut out of the market. In colored yarns Barcelona dyers have now secured a strong footing with aniline reds, but in other colors the Glasgow dyers continue to hold their own against all comers.

In printed cotton cambrics the Barcelona printer has gained ground considerably; hitherto his inability to give fast colors at a reasonable price has proved a stumbling block, the imports of "Steams" (loose colors) to these islands being comparatively small. The difficulty he has now overcome. In printed jaconets practically the entire import comes from Glasgow, even the Lancashire printers being unable to give the exact finish required by the native consumer. In various classes of fancy muslins a large increase of home production has been the feature in recent years. In the native weaving of these fabrics hemp and pineapple fibre largely enter, and on this account they are more durable than the cheap muslins imported from Europe.

During the year 1897 the imports of cotton goods into the Philippine Islands had a total value of about $5,350,000 and were divided as follows:

WOVEN FANCY GOODS (ginghams, grandullys, muslins, regattas, trouserings, etc., etc.)	$1,900,000
PRINTED GOODS (prints, printed grenadines, etc.)	1,350,000
Yarns and sewing thread	650,000
Shirtings, gray cloths, drills (white and twills), croydens, etc.	1,500,000
	$5,4000,000

Articles of Importation.

In the matter of cotton yarns Barcelona was favored, not only by the tariff, but also by the adoption of a different numbering of the yarns—a numbering preferred in Manila, but which Great Britain, Germany and Switzerland refused to use.

Thus, for instance, in Manila

No.	10	is marked	as	No	24
"	16	"	"	"	30
"	18	"	"	"	32
"	22	"	"	"	40
"	36 or 40		"	"	60
"	32		"	"	50

Four-fifths of the yarn arrives unbleached, one-fifth bleached.

Dyed yarns, light red, orange and green are especially popular in numbers 20 and 32. Fast Turkish red yarns in the numbers from 20 to 40, ordinary numbering, formerly came from Elberfeld and from Switzerland, but now come mostly from Spain.

Unbleached and bleached shirtings and drills, one of the principal articles of importation, were formerly furnished exclusively by Manchester. The greater part now, however, comes from Barcelona, and only one-fourth of the bleached shirtings—finer grades with a special finish—is supplied by Great Britain. The Spanish have been very successful in adopting the kinds, lengths, widths and finish long ago introduced into the market. As regards the length and width of the pieces, a steady decrease in the dimensions is notable.

At present there are imported,

White shirtings	26	inches	wide	and	40	Varas	or	36	yards long.
Gray T. cloth	25	"	"		24	"	"	21½	"
" long "	28	"	"		35	"	"	32	"
" twills	25	"	"		30	"	"	27	"

Printed calico and cambrics, 24 inches wide, generally with red grounding now also come mostly from Spain. Great Britain has of late done a considerable business in printed fancy crimps. Germany is not represented in this article.

Ginghams—Chellass for sarongs and bedding, 60 cm. or 23.6 inches wide, 24 yards long, common quality, large pattern with red grounding and yellow and blue squares, to a lesser degree with green and indigo-blue grounding, have of late found increased favor, but are only imported from Barcelona.

Cotton trouserings (cassimetas and drills) on the other hand are even at present imported from Germany, generally in double width, 129 cm. or 47.3 inches, less in 6 cm. or 23.6 inches. Perhaps 110 cm. or 43.3 inches would be sufficient even for double width, as the Tagales are as a rule slimly built. Light grades are preferred in accordance to the climate. The Spanish already furnish very creditable white-grounded fancy drills and satins and tastefully printed moleskins and trouserings. Victo-

ria laws, smooth and checked muslins in different kinds are supplied by Scotland.

Cotton flannelettes 25 to 26 inches wide, printed in flowers, have lately been successfully imported from Germany in competition with English goods.

Molton from Bocholt, 63 cm. or 24.8 inches wide, printed on both sides, black on white or black on red, common goods worth about 4.6 cents a yard is somewhat in demand.

Printed calicoes, 25 by 27 inches, come from Scotland. Imitations already come from Barcelona. Handkerchiefs, 17 by 18 inches and 22 by 22 inches, white and white with colored printed border, partly embroidered and with hemstitched borders, have also been sent from Spain.

Black cotton zanellas, 28½ inches wide, 10 to 11 cents a yard, used for skirts, are supplied by Germany, as are also, to a smaller degree, some colored ones.

Germany also furnishes aniline-black satins in 110 cm. or 43.3 inches wide.

Quiltings now and then form a very important article of import, and whereas Spain already supplies most of the white quilts, the colored, fancy ones still come from Germany. Cheap grades are predominantly in demand, colored more so than white. The Agricultural laborers sometimes, when good crops permit such a luxury, cut a hole in the middle of a quilt and use it as a poncho.

In undershirts alone, the annual consumption is estimated at 500,000 dozen. They are sold in 27 inch lengths and 34 to 40 inch sizes, bleached white, striped in colors, printed in colors or in netting. With the exception of a few finer grades, worth $3.81 per dozen, which are still furnished by Germany, all these goods come from Barcelona, where quite a good undershirt is sold as low as 72 cents a dozen. Two-thirds are made with half length sleeves, one-third with long sleeves.

In socks (in sizes 9 to 11 inches) and in ladies' stockings (8 to 9½ inches) the case is similar. Barcelona monopolizes the lower grades, Germany only supplying the better ones.

It is evident then that a trade worth seeking exists but the American cotton manufacturers in seeking it must study carefully the wants of the market and the character of the goods hitherto supplied by the largest seller, namely, Spain. The fact should not be lost sight of that the Philippines produce a very fair native cotton, the production of which is likely to be stimulated by settled conditions.

HAWAII.

Hawaii, with its eight islands, in area about equal to New Jersey, though containing only a handful of people, a little in excess of 109,000, must not be left out of consideration in discussing increased outlets for our cotton products.

It is worthy of record, that the islands are credited with a trade balance which has amounted, at times, to as much as $8,000,000 a year. The sum, however, of all her virtues is, from a commercial point of view, that Hawaii buys from us 76 per cent. of all she requires, and sells to us 99 per cent. of all she produces. Facing such a trade condition in the present, we may reasonably dismiss the fear that trade rivals have, in times past, encroached upon our territory in this group of islands. Conditions now prevailing in Hawaii are clearly favorable to increased trade. Sugar exports nearly doubled between 1895 and 1897. Coffee exports, which amonnted to but 3,051 pounds in 1891 have now increased to a total of 337,158 pounds. There is serious, and it would seem well justified, talk of a revival of cotton cultivation.

The importation of textile goods into the Hawaiian Islands has been comparatively steady, with a tendency towards a general increase. There is a gratifying increase in the popularity and use of American goods.

The total value of the imports of textile goods into the Hawaiian Islands was:

	1893	1894	1895	1896	1897
Cottons	$269,598	$288,945	$360,832	$311,891	$362,150
Linens	21,327	9,481	10,172	12,634	21,750
Silks	17,565	12,213	17,729	20,953	40,550
Woolens	52,447	47,870	45,017	69,368	67,845
Mixtures	17,886	9,317	6,514	10,933	7,500

The following countries contributed to the importations in 1897:

	Cottons.	Linens.	Woolens.	Silks.	Mixtures.
United States	$267,000	$1,300	$10,000	$1,700	$ 750
Great Britain	73,000	19,000	40,900	4,300	2,400
Germany	1,350	500	16,000	250	1,000
Japan	16,500	650	1,200	13,500	150

As the figures thus show, over 70 per cent. of the cotton imported into the Hawaiian Islands are products of American mills. The importations from Great Britain have been falling off, and there are prospects of a continued decline. The cotton goods which find the largest market in the islands are white-ground prints, used for dresses by the native women and the Japanese inhabitants, and denim used for suits by the native, Japanese and Chinese population.

Prints form the principal item of cotton goods imported. The value of the total importation in 1897 was $54,922, $50,644 being from the United States and $4,278 from England.

The American manufacturer produces a light ground print in good designs at from two and a fourth cents to three cents a yard, the cloth being light in weight, but also pure in finish, and, consequently, soft and suitable for wear in a sub-tropical climate, The fact that this print can be worn without first being washed adds greatly to its selling quality, and the Manchester cloth of the same width (24 inches to 26 inches) being heavily dressed, is unable to compete with the purer American cloth.

There is a large sale for dark ground 25-inch prints, costing in New York from three and one half cents to four cents a yard. In designs, colorings and finish, these are much superior to the British-made article at the same price. In fact, prints under four cents a yard from Great Britain have been driven out of the

Hawaiian market by the American article, which, in addition to being better fitted for the market, is aided by a cheap rate of freight and by a ten per cent. tariff in its favor.

Fully 90 per cent. of unbleached and bleached calicoes are now drawn from the United States, owing in some measure to the fact they can be landed much cheaper than from Europe. Grey calicoes imported are principally from the Southern States, and bleached goods from the Northern States, though there is a tendency which promises growth that in a short time all the calicoes will be imported directly into Hawaii from the Southern cotton fields.

In the better class of printed goods, the British manufacturers still more than hold their own. In this class of goods the American manufacturer is also making rapid strides, in the direction, however, of competition with French rather than English printers.

The small trade in these islands in fancy patterns, art muslins, cretons, etc., has been, up to the present chiefly with England; but, unless English manufacturers improve the general tone of their designing and coloring, the business will ultimately fall to American manufacturers, who are making strenuous efforts to secure it. It is important that traders should realize that there is no "Kanaka" trade, and the days of gaudy patterns and brilliant colors are past, and that styles that "take" at home are the styles that are required in Hawaii.

The United States has a monopoly in denims or dungarees and is likely to retain it. The whole importation in 1897 valued at $51,574 was from the United States. American manufacturers make a specialty of this trade, and produce an excellent indigo at nine cents or denim at nine and one-fourth cents a yard, prices including cost of packing and casing.

The principal trade in ladies' and men's hose and half-hose is in cotton and plain black goods. These goods are almost entirely of German make, and it is found that the Hermsdorf dye retains its color where English dyes fade out into browns or greens. There is apparently a deficiency in English dyes, as

well known English dyes like the "Diamond" and "Sanitary" fail to stand, while the Hermsdorf dyes stand fast through all tests.

Among the influences, aside from the superiority of the goods in some cases, which have aided American goods in capturing the Hawaiian market over European goods are:

1st. The advantage of much lower freight rates.

2nd. A preference in the customs duty. Under the Reciprocity Treaty before the recent annexation, nearly all the manufactures and products of America were admitted into Hawaii free of duty, while goods of European manufacturers have had to pay duties ranging from 10 per cent. to 25 per cent. ad valorum.

3rd. Packing and casing. The cheap and good packing and casing of all cotton goods imported into Hawaii from the United States is an item very much in their favor. All quotations on American cottons include free packing and casing and the wood compares favorably with that used in the Manchester, Glasgow and London packing. A feature of the American packing is that all the boards in the cases are tongued and grooved. This not only renders the cases tight and dust-proof but adds very materially to their strength, and greatly assists the proper carrying of the goods.

PORTO RICO.

Unlike our new possessions in the far and near Pacific — the Philippines and Hawaii — Porto Rico is charged with a debit balance; imports slightly exceeding in value the exports; but with the United States are the other way, for in 1897 the imports by Porto Rico from the United States were valued at $1,988,888, her exports to the United States $2,181,024. Regarding the exports it may be broadly stated that coffee furnishes 63 per cent. and sugar 28, leaving only nine per cent. for all other exportable commodities.

The detailed statistics of the importation of cotton goods into the island of Porto Rico during the year of 1897 follow the sta-

tistics for 1898; owing to war disturbances, having small interest or value.

Country of Origin.	Value, Pesos.
Spain	1,914,064.64
England	448,472.07
France	26,760.02
Germany	23,174.77
United States	10,368.83
Belgium	587.00
Austria	31.24
Total	2,423,458.57

As exchange in Porto Rico fluctuates, the value of the peso in United States gold can only be given as between 50 and 60 cents.

CUBA.

In making an estimate of the probable quantity of cotton goods likely to be absorbed by regenerated Cuba, the safest course of precedure will be to rest such an estimate on the present economical conditions.

The principal elements of improvement in the present situation, compared with the former are: first, the elimination of numerous vexations and uncalled for impediments to trade; second, the relief from excessive taxation, inclusive of the interest which the island has had to pay on the so-called War Debt amounting to $360,000,000; third, greater security to life and better conditions of sanitation, better roads, which will make intercourse and traveling less dangerous; fourth, expenditure of Cuban revenue in Cuba and for the benefit of Cubans; finally, an influx of American money, brains and muscle that must stimulate life in the body — social, political, commercial.

In making comparison with any of the years before the war, it must be borne in mind that the average purchasing power of the Cuban population was then reduced to an exceedingly low level. The Cuban producer did not profit to any reasonable extent from the fruits of his labors. Most of the year's surplus

went into Spanish channels and was expended out of the Island; only a small portion of the revenues were devoted to Cuban administrative and educational affairs, none to public improvements. Bearing in mind the causes limiting the purchasing power of the Cuban people, let us examine the figures of the year 1893, a comparatively prosperous year, when the population of Cuba was about 1,800,000, and the harvest of sugar above the average of 1,000,000 tons. No Cuban statistics being available, the following figures concerning importation of cotton goods in 1893 are derived from the official returns of the principal exporting countries.

Cotton Goods in Cuba.

The importations of cottons in that year amounted to nearly $6,000,000, distributed as follows:

Spain	$4,266,000
France (tissues, passementerie, ribbons)	96,776
Germany (by Hamburg) including hosiery	41,286
England	1,443,286
United States	148,178
	$5,996,526

The imports from the United States, small as they were in 1893, have still further diminished during later years, they were $70,629 in 1896, $33,537 in 1897, $89,874 in 1898, but the proportion in the general importation has increased, the decrease of the importation from other countries having been at a still greater rate.

That the share of the United States in this trade can and will be largely increased, there is little doubt. Indeed there is legitimate reason to anticipate in Cuba an outlet for American cottons to the extent of 10 or 12 million dollars per annum, under the new conditions of life and trade that will develop, and develop rapidly, under a stable and liberal government. Passing from a view of general trade conditions, let us study in detail the condition of that department of import business in which the

cotton manufacturer is interested. 73 per cent. of the goods furnished from Barcelona were white tissues. Considering the customs of the people, it is natural to assume that the greater portion consisted of duck, which, with linen, forms the exclusive material for men's every-day wear — of sheetings, shirtings, percales, drills.

There is considerable demand for canvas and tarpaulin, as covering for country wagons and boats, especially market boats. In the numerous harbors also where the wharves are not covered, canvas is used to protect the merchandise from the rain.

All the materials necessary for making the Cuban bed can be furnished in excellent quality from this country. It consists of a wire mattress, over which is placed a light quilt or "colchoneito," then two sheets and a white cotton cover.

The laboring people in the country have additional reason to be partial to their suits of white cotton stuff in the existence of certain insects, called nigua, which thrive and breed in woolen garments, whereas the wearer of cotton or linen is rarely troubled with them. This insect digs under the skin and causes excruciating pains.

There is, however, a great quantity of half-woolen goods and linen imported; while the importation of silk goods has at all times been considerable.

Light, airy weavings and rich, high colors naturally constitute the main characteristics of cotton dress goods for a southern market. But it would be a mistake, with regard to Cuban society, to construe this as a demand for "loud" colors. If one studies the warm, deep red of the Aragon patterns, or the lively but chaste mixtures of green with stripes of other colors in the Sevilla fancies, it will be seen that an artistic instinct strives earnestly to find expression in the arrangement of colors, flowers and figures.

It is expected that ready-made wrappers, and men's clothing will have a large sale when styles and prices have once been established and become known.

As the density of the tissues is of paramount importance for

the suitability of goods, the following account of various classes, as formerly imported into Cienfuegos, is of importance:

White shirtings,	64	grams	per yard,	14-16	threads	per	centimeter
"	50	"	"	10	"	"	"
Striped "	55	"	"	10	"		
White sheetings,	90	"	"	10	"		
"	75	"	"	16	"		
Printed percales,	90	"	"	13-16	"		
Dress goods,	27	"	"	12	"		
"	40	"	"	14	"		
Drills,	110	"	"				

Cuban trade is at present in the hands of Spanish merchants; but American cotton goods exporters need not feel any apprehension on that account. The market is at their doors; transportation facilities and freight rates give them an advantage in entering it; quality of goods and enterprise should enable them to control it.

The PRESIDENT. Are there any remarks any member would like to make in regard to this subject or any inquiries? If not, we will pass to the next paper, "Methods of Cost Finding in Cotton Mills," by Mr. WILLIAM G. NICHOLS of Chester, S. C.

Mr. LOUIS SIMPSON. Mr. President, this is a very important paper, but a very lengthy one, and really no one here can do justice to it in discussing it unless he has it at home and goes over it carefully. I would propose that the paper be read and discussion be deferred till our next meeting. I think by so doing the Association will get more benefit out of it than by attempting today to discuss it.

The PRESIDENT. Our Secretary tells me that that was the intention of the Board of Government, that the discussion of this paper should be postponed until the next meeting.

METHODS OF COST FINDING IN COTTON MILLS.

WILLIAM G. NICHOLS, Chester, S. C.

The subject of Costs of Manufacturing appeals to every practical manufacturer, since it is one with which he has periodically a vital interest. Some method must be resorted to, in order to determine what are the results for which the business has been carried on. It may be simple and elementary, or complicated and deeply analytical. Three points are essential, that it be *accurate*, *simple* as possible, and *inexpensive*. A manifold way of spelling practicable.

A good system has three uses. First: A means of making, periodically, a reliable estimate of the cost of goods actually manufactured. Second: A basis for making estimates on samples of goods of similar character, proposed to be made. Third: A means of comparison of expenses at different times.

There is no one method best for every mill. Any good system may need fitting to the exact circumstances of a new application. Some elaborate method may be capable of adaptation to all mills, plain and fancy, but if the same results might be reached by the simpler means, the increased labor would be folly.

No system is proof against errors, or manipulation in the hands of the clerk, even though the accounts are plain. Where there is a wide diversity of work, a considerable knowledge of the mill is needful either in the cost clerk, or in his immediate supervisor, to properly include all the operations in their right proportion and order.

In the methods described herein, an attempt is made to illus-

trate various systems, ***which are not new in their principles***, but which contain numerous expedients, which have never been described before, so far as the writer is aware. Throughout, ***no pretence is made of giving actual costs***, some are higher than would be the case in most mills, others are lower.

The Average Number idea has, for many years, been the central feature of the plan in common use. But the increased variety of organizations, made to fill modern needs and uses, has stretched it beyond its original restrictions, has shown its limitations, and proved it to be inadequate.

Before any set of accounts can be closed, it is necessary to decide upon what shall be included in the manufacturing expenses. Apparently, it is usual to carry the accounts so far as is necessary to obtain balances which will show the outcome of business, and charge to expenses for depreciation, and from such other accounts as may be temporarily closed or carried, such amounts as seem advisable, having in view the present and future gain. Aside from these adjustments to circumstances, it is a matter requiring some appreciation of the use to which the expense balances are to be put, to keep them free from modification by improper credits. It is assumed herein, that there is an honest desire to determine the actual facts concerning the costs of fabrics made, and that the accounts have been made up and closed, fairly.

A certain mill in making up its accounts, takes a careful inventory of the stock in process, and places value upon it, according to this rule: One cent per pound for the stock, and add the labor cost, up to the department where the stock is in process. This is neither honest book-keeping, nor fair to the management. In this case, it is an old custom, not easily changed. Consequently, if the stock in process at the end of the six months, exceeds what it was at the beginning by thirty thousand pounds, the Cotton Account loses a credit due it, of about two thousand dollars (when clean cotton is worth seven cents a pound). Again other mills close their Cotton Account by a credit of all the stock in process at its value, plus the labor

on the same, up to the department in which it is inventoried. A case of crediting to the wrong account.

In another instance the treasurer of a mill, finding the waste account too large, added, on the books, to the stock in process, believing that some error had been made, which upon careful examination, failed to be detected. At the end of the six months, there was still the same deficit, which seemed to prove that the original mistake, had been made earlier than was supposed. The addition to the stock in process had now to be borne as a loss, or carried on indefinitely.

A mill actually loses nothing by either of these practices, but does make a false, or at least a faulty statement of its current expenses, and profits and losses.

Considering these preliminaries to be settled, and the final balances taken off, the calculation of the detailed cost of each kind of goods manufactured, must be made.

In the case of a mill engaged in making only one line of goods, this is a simple matter. It is a lesser problem than to decide what shall be charged to manufacturing, or for depreciation, new machinery or the division of extraordinary expenses, as insurance and taxes.

METHOD I.

The expenses of manufacturing having been settled upon, in a mill such as last mentioned, it only remains to divide their sum by the yards and pounds made, to obtain the cost per pound and yard.

It may be interesting and useful to further divide the cost among the various departments, as Carding, Weaving, Repairs, etc., and to make comparisons with other periods of running. Indeed, this matter of computing manfacturing costs is so simple, under such conditions, that a fairly accurate figure may be arrived at, without an inventory of stock in process. It may be reckoned monthly, either with or without an inventory, for the sake of comparison, and an accurate cost determined every sixth month, when accounts are closed.

Such an account may be entered in a book, ruled and bound for the express purpose, somewhat as follows:

Cloth made,		
Pounds,		
Yards,		
LABOR.	Amount,	Cost per pound.
Carding,		
Frame spinning,		
Mule spinning,		
Warping,		
Dressing, etc.,		
Weaving,		
Cloth room,		
Total labor,		
SUNDRIES.		
Starch,		
Power,		
Light,		
Oil,		
Supplies,		
Repairs,		
Taxes and Insurance,		
General,		
Total,		

Within the last fifteen years the conditions surrounding many of our mills have changed. On the one hand, competition has reduced the margin of profit in manufacturing, and rendered imperative the reduction of all but the most necessary expenses, and also in those mills making a variety of goods, a closer inquiry into the relative costs of manufacture. Where a mill has departed from producing a single style of goods, to a variety of similar organizations, it is possible by an examination of the costs of various departments, to estimate with great accuracy the total cost of each kind of goods. In such a mill, where the yarns do not vary widely in number, and the organizations of the goods are not greatly dissimilar, the following method may be used with convenience:

METHOD II.

This method follows the plan of separating such expenses as are common to the entire output of the mill, and dividing them in the proportions of the average numbers of the yarn employed in the construction of the different kinds of goods. These expenses of Carding, Spinning, Repairs, etc., are called "Costs in Common." Such expenses as are not common to all classes of goods, but are incurred only on certain classes, are termed "Special Costs," and are divided only among goods where the cost is incurred.

Various rules for finding the "Average Number of Yarn" are in use, but the following has the merit of being based on reason, and, therefore, of correctness.

Divide the sum of sley and picks, by sum of sley divided by the number of warp yarn, and the picks per inch divided by number of filling yarn.

The rationale of the rule is as follows:

The sley divided by the number of the warp yarn gives the number of ends of number one yarn, that would be equal in weight to the warp used.

The picks per inch divided by the number of the filling yarn, equal the number of threads of number one yarn, which would equal the picks per inch of filling used.

The picks and sley are thus reduced to a common basis, that they may be added together. Added, they represent the number of threads of number ONE yarn equal in weight to the threads of warp and filling.

This weight of yarn is now to be divided into as many threads as there were before, but they are to be of equal size. Mathematically this is done by dividing these threads of number one yarn by the sum of picks and sley. The result is "The Average Number of the Yarn."

The average number of yarn in cloth "G," in the succeeding example is as follows:

25 Warp, 18 Filling, 86 Sley, 46 Picks per inch.

$$86 \div 25 = 3.44$$
$$46 \div 18 = 2.56$$
$$6.00$$

86 (sley) + 46 (picks) equals 132.

132 ÷ 6 equals 22, the average number of the yarn.

Suppose the mills were manufacturing the following kinds:

	Goods.	Warp.	Sley.	Filling.	Picks.	Width. Inches.
G	Flannel	25	86	18	46	25
C	"	22	76	12	48	25
XX	"	19	70	4	48	32
R	Sheeting	19	64	24	68	36
S	"	22	56	22	56	37½
F	"	19	64	24	68	42

And the six months production to have been,

800,000	lbs. of "G"	Flannel,	brown,	5	yards per lb.
1,000,000	" " "C"	"	"	4	yards per lb.
400,000	" " "XX"	"	bleached	1½	yards per lb.
2,000,000	" " "R"	Sheeting,	brown,	3½	yards per lb.
300,000	" " "S"	"	"	4	yards per lb.
200,000	" " "F"	"	"	3	yards per lb.
4,700,000					

First find the Average Number of yarn in each cloth. By the rule given above they are

Cloth.	Average Number.	Cloth.	Average Number.
G Flannel	22.	R Sheeting	21.29
C "	16.64	S "	21.96
XX "	7.53	F "	21.29

From the total production of the six months, and the Average Number of each kind of cloth we obtain the Average Number of the Mill, thus:

G Flannel	800,000 lbs.	x 22.	=	17,600,000	hanks.
C "	1,000,000 "	x 16.64	=	16,640,000	"
XX "	400,000 "	x 7.53	=	3,012,000	"
R Sheeting	2,000,000 "	x 21.29	=	42,580,000	"
S "	300,000 "	x 21.96	=	6,588,000	"
F "	200,000 "	x 21.29	=	4,258,000	"
	4,700,000			90,678,000	

90,678,000 ÷ 4,700,000=19.29, Average Number of the Mill.

Next find the Labor Cost per pound from the Pay Roll.

Picking,	$11,578.00
Carding,	24,780.00
Warp Spinning and Spooling,	30,380.00
Mule Spinning,	12,320.00
Warping, Dressing, Drawing in,	11,830.00
	$90,888.00

$90,888.00÷4,700,000=1.933 cents per pound, Labor Cost.

Throughout this series, the decimal point, in figures representing costs per pound, is always placed between cents and mills.

From the Pay Roll, we also find the number of cuts woven of each grade of cloth. This, multiplied by the price per cut, gives the piece work. Deducting the sum of these products from the total amount spent for weave room labor, leaves the balance expended for day work. Add to the cost of piece work on each grade, the same percentage as the total day work, is to the total piece work.

Divide this total cost of weaving each grade, by the pounds of same produced, as follows:

Cloth.	Pounds Produced.	Total Wages.	Weaving Cost per pound.
G	800,000	$19,315.00	2.419 cents.
C	1,000,000	19,890.00	1.989 "
XX	400,000	4,685.00	1.171 "
R	2,000,000	47,736.00	2.387 "
S	300,000	7,137.00	2.379 "
F	200,000	4,095.00	2,048 "
		$102,843.00	

Next find the "Special Expense" of Sheetings:

Burlaps,	$3,000.00
Rope,	1,700.00
Twine,	530.00
Paper,	700.00
Stamps,	50.00
Sundries,	150.00
Total,	$6,130.00

Total pounds of Sheetings:

R	2,000,000
S	300,000
F	200,000
	2,500,000 pounds.

$6,130.00÷2,500,000=.2452 cents, the cost per pound of "Special Expense of Sheeting."

"Special Expense" of Flannels:

Napping,	$3,000.00
Flannel Cases,	1,144.00
Stamps,	140.00
Paper,	26.00
Sundries,	300.00
Total,	$4,610.00

Total pounds of Flannels:

G	800,000
C	1,000,000
XX	400,000
	2,200,000 pounds.

$4,610.00÷2,200,000=.2095 cents, cost per pound of "Special Expense" on Flannels.

"Special Expense" on Bleached Flannels:

Net cost of Bleaching,	$6,000.00
Freight,	1,000.00
Extra handling,	200.00
Sundries,	800.00
Total,	$8,000.00

$8,000.00÷400,000, the pounds bleached, equals 2 cents per pound, "Special Cost of Bleaching."

The cost of cotton:

Stock in process, Jan. 1. Value,	$110,000.00
Raw cotton used six months,	500,000.00
	$610,000.00
Stock in process, June 30,	73,600.00
	536,400.00
Less value of waste sold,	12,400.00
Value of cotton used,	$524,000.00

$524,000.00÷4,700,000 pounds of goods produced equals 11.149 cents per pound, cost of cotton.

GENERAL EXPENSE.

Cloth room,	$14,077.00
Repair shop,	9,050.00
Belt and Roll shop,	5,853.00
Yard and watch,	7,875.00
Engineers,	4,501.00
Materials for repairs,	11,879.00
Supplies and sundries, gas,	17,115.00
Fuel,	14,805.00
Starch,	8,288.00
Salaries and Office expense,	7,154.00
Insurance and taxes one-half year,	25,900.00
New machinery,	23,500.00
Treasurers' office, interest, etc.,	28,000.00
	$177,997.00

$177,997.00÷4,700,000=3.787 cents per pound, General Expense.

COST IN COMMON, LABOR AND GENERAL EXPENSE.

Labor, manufacturing, per pound,	1.933	cents.
General expense,	3.787	"
Total,	5.720	"

This average cost per pound is now divided by the "Average number of the Mill," to obtain the "cost per number," or "cost per unit," or "cost per hank" or "skein" as it is variously called. 5.720 cents divided by 19.29 the "Average number of the Mill," equals .2966 cents per number, cost of Manufacturing Labor, and General Expense.

COST OF LABOR AND GENERAL EXPENSE, EACH KIND OF GOODS.

Kind.	Average Number.		Cost per lb. pr. no.		Cost per lb. Goods.
G	22.	x	.2966	=	6.525
C	16.64	x	.2966	=	4.935
XX	7.53	x	.2966	=	2.333
R	21.29	x	.2966	=	6.315
S	21.96	x	.2966	=	6.513
F	21.29	x	.2966	=	6.315

SPECIAL COSTS PER POUND, EACH KIND OF GOODS.

First find the average number of the Sheetings:

	Pounds produced.		Average number.		
R	2,000,000	x	21.29	=	42,580,000 hanks.
S	300,000	x	20.96	=	6,288,000 hanks.
F	200,000	x	21.29	=	4,258,000 hanks.
	2,500,000				53,126,000

53,126,000 hanks ÷2,500,000=21.25, the average number of the Sheetings. .2452 special cost per pound of Sheetings, ÷21.25=.0116 cents per number.

COSTS PER POUND OF GOODS.

	Average Number.		Cost per lb. pr. no.		Cost per lb. Goods.
R	21.29	x	.0116	=	.247
S	20.96	x	.0116	=	.243
F	21.29	x	.0116	=	.247

FLANNELS.

First find the average number of the flannels.

	Pounds produced.		Average number.		
G	800,000	x	22.	=	17,500,000 hanks.
C	1,000,000	x	16.64	=	16,640,000 hanks.
XX	400,000	x	7.53	=	3,012,000 hanks.
	2,200,000				37,252,000 hanks.

37,252,000 hanks, ÷2,200,000=16.93 "Average number of Flannels." .2095 cents per pound, special cost of Flannels,÷16.93=.0124 cents, cost per number of Flannels.

COSTS PER POUND OF GOODS.

	Average Number.		Cost per lb. pr. no.		Cost per lb. Goods.
G	22.	x	.0124	=	.273
C	16.64	x	.0124	=	.206
XX	7.53	x	.0124	=	.093

SUMMARY OF COSTS PER POUND.

	G	C	XX	R	S	F
Cotton,	11.149	11.149	11.149	11.149	11.149	11.149
Costs in Common,	6.525	4.935	2.333	6.315	6.513	6.315
Weaving,	2.419	1.989	1.171	2.387	2.379	2.048
Special Sheeting,				.247	.243	.247
Special Flannel,	.273	.206	.093			
Special Bleaching,			2.000			
	20.366	18.279	16.746	20.098	20.284	19.759

COSTS PER YARD.

	Cost per lb.		Yards per lb.		Cost per yard.
G	20.366	÷	5.	=	4.07 cents.
C	18.279	÷	4.	=	4.56 "
XX	16.746	÷	1.50	=	11.16 "
R	20.098	÷	3.50	=	5.74 "
S	20.284	÷	4.	=	5.07 "
F	19.759	÷	3.	=	6.59 "

PROOF.

Carding, etc.,	$ 90,888.00
Weaving,	102,858.00
Cotton,	524,000.00
General Expense,	177,997.00
Special Expense, Sheetings,	6,130.00
Special Expense, Flannels,	4,610.00
Special Expense, Bleaching,	8,000.00
Total cost from Mill account books,	$914,483.00

800,000	lbs.	G	at	20.366	=	$162,928.00
1,000,000	"	C	"	18.279	=	182,790.00
400,000	"	XX	"	16.746	=	66,984.00
2,000,000	"	R	"	20.098	=	401,960.00
300,000	"	S	"	20.284	=	60,852.00
200,000	"	F	"	19.759	=	39,518.00
Estimated cost,						$915,032.00

$915,032.00 minus $914,483 equals $549.00 discrepancy in proving. This is about one-twentieth of one per cent. and if the decimals were carried farther, this would be done away with.

In calculating by the foregoing method, it is not unusual to estimate the cost of weaving by the average number in the same manner as the carding, etc. An expense so great as weaving, greater than carding, spinning, warping and dressing, combined, is worthy of being determined with decision. More especially, as this may usually be done with very little labor. If there is a different price per cut for weaving each mark of goods, it is only needful to count the pieces at each price, and multiply by the price. Add the day labor either in a per cent. of the piece work, as previously described, or in proportion to the looms run on various kinds of cloth.

A modification of this system, by which the cost is carried to completion, reckoning by the cost per hank, for cotton, labor, repairs, etc., is sometimes followed. The hanks per yard of warp and filling are separated in calculating the cost of carding,

spinning and dressing, and the total hanks per yard used in subsequent operations and for general expenses. Though simpler in detail, this method is not so directly available for making estimates of samples of goods proposed to be made, as to calculate cost by the pound.

This system affords a popular and convenient method of making up costs in mills where there is a limited range in the numbers spun and in the organizations.

Where there is a wide variety of yarns made, and where the other disturbing elements, frequently encountered, occur, such as, a portion of the product sold as yarn, or yarn purchased, a variety of stock used for different grades, and special processes, as combing, extra or slack twist, the methods previously described are insufficient.

They may be used in part and supplemented by guess work. But even an "educated guess" is likely to be so far afield, that when by a reasonable amount of clerical work, a cost figure can be obtained upon which one may rely with confidence, the greater satisfaction and certainty require its expenditure.

A "proof" such as shown in the preceding illustration is sometimes triumphantly exhibited as demonstration of correct cost estimation, when it is, in truth, only a proof of the mathematical calculations, having been correctly performed. It would be as reasonable to suppose that because four men weighed alike, they were therefore all the same height.

It should be remembered, also, that in the foregoing methods, if one figure is too high, another *must* be too low, which is likely to lead to a loss of business on the over-rated goods, and an increase on the undervalued.

An estimate too low may be a serious matter, compared with which, the labor necessary to obtain reliable figures would be trifling.

That the "Average number" hypothesis is not exact, and further that for wide ranges of numbers it is thoroughly unreliable, is demonstrated not from principle alone, but also from actual observation and examination of fact.

Let us first examine the Card room. By the "Average number" system the estimated cost of making roving varies in a sliding scale in proportion to the number of yarn spun, which is not the case as a fact. The roving is not made in a separate size for every number of yarn, but a few sizes answer for a certain range of yarns. For instance, 3.50 hank roving may serve for spinning single, any yarn which may be required from 21 to 35. The cost of carding would be the same for either number. Or 6 hank roving might serve double or single, for any number from 24 to 48, and the cost of carding would be the same. Neither does the cost of carding vary in the same ratio as the number of the hank roving.

It happened to the writer some years ago, to make a detailed examination of the cost of carding in a certain mill, with the following results:

Cost of	Carding,	2.70	hank	roving,	1.05	cents	per	lb.
"	"	4.10	"	"	1.11	"	"	"
"	"	5.40	"	"	1.42	"	"	"
"	"	6.00	"	"	1.45	"	"	"
"	"	8.30	"	"	1.75	"	"	"
"	"	12.00	"	"	2.04	"	"	"

It will be noticed that 2.70 is about one-third of 8.30, but the cost of making 2.70 is about two-thirds that of making 8.30, instead of one-third. 12.00 hank costs less than twice as much as 4 hank, rather than three times as much.

In another mill the cost of making rovings, ran as follows:

Cost of	Carding,	.59	hank	roving,	.50	cents	per	lb.
"	"	.75	"	"	.54	"	"	"
"	"	1.25	"	"	.67	"	"	"
"	"	2.00	"	"	.74	"	"	"
"	"	2.50	"	"	.76	"	"	"
"	"	4.00	"	"	.99	"	"	"
"	"	6.00	"	"	1.22	"	"	"

In the Spinning room, the departure from the ratio is not so great, but is evident from the following costs of spinning:

Cost of	Mule	Spinning	No.	6.25	yarn,	.43	cents	per	lb.
"	"	"	"	8.00	"	.47	"	"	"
"	"	"	"	9.00	"	.53	"	"	"
"	"	"	"	11.00	"	.56	"	"	"
"	"	"	"	12.00	"	.62	"	"	"
"	"	"	"	14.00	"	.66	"	"	"
"	"	"	"	18.00	"	.96	"	"	"
"	"	"	"	20.00	"	1.01	"	"	"
"	"	"	"	24.00	"	1.08	"	"	"
"	"	"	"	28.00	"	1.15	"	"	"

In practice there comes a time when the cost of spinning, instead of growing less per pound, as the yarn becomes coarser, increases on account of the loss in production, due to the large amount of time consumed in doffing.

These considerations force us to the conclusion that under extreme conditions, or unusual circumstances the system of average number fails of being applicable. In the following examples we will take up methods applicable to organizations and fabrics requiring special treatment, and in which the cost of carding and spinning involves, comparatively, but little labor or importance.

The first of these will exemplify a method applicable to a colored mill, making a variety of goods, not of extremely various organizations, but containing some elements not encountered in white mills.

METHOD III.

The semi-annual account of a colored mill shows the following results. As in most colored mills, the goods were finished at the mill, and the following pounds and yards were finished and invoiced, or on hand:

Staple Ginghams,	800,000	lbs.	5,200,000	yds.
Dress Styles Ginghams,	206,000	"	1,300,000	"
33″ Shirting,	294,000	"	1,440,000	"
28-½″ Shirting,	98,000	"	517,000	"
Columbian Cloth,	41,200	"	206,400	"
Double Flannel,	19,600	"	56,840	"
	1,458,800	"	8,720,240	"

The organization of each of these is given later. It is sufficient at present to say, that the Staple Ginghams are even checks of white, and blue, brown, or some other color.

It is well known that cotton yarn, in dyeing, gains in weight by the addition of dye stuff, in various degrees, dependent upon the nature and amount of the dye. And that on the contrary, by the process of bleaching, a certain amount is lost in weight, by the removal of matter from the cotton. It is probably within the limit of fact to set the gain or loss at three per cent., although yarn, bleached, dried, and weighed at once after drying, would doubtless show a greater loss than this, on account of abnormal dryness.

The Staple Ginghams being one-half colored and one-half bleached yarn, the loss and gain may be assumed to balance each other, so that the finished cloth will weigh the same as grey cloth, 6.50 yards per pound. Not so with the second class of goods. These are exactly the same organization as the Staples, but in dress patterns containing a variety of colors, but no white or bleached yarn. As weighed from the cloth room, these goods average 6.35 yards per pound. To obtain the cost per pound of these goods, and divide by the yards per pound, to obtain the cost per yard would be unfair, as the relative amounts now stand.

There is no more *cotton* in the dress patterns than in the Staples, and this inequality must be adjusted. This is done by deducting three per cent. from the total pounds of the goods, an allowance for the extraneous weight of the dye.

206,000 lbs. – 3 per cent. = 200,000 lbs. net, of grey cloth.

These two classes of goods are not very heavily starched in finishing, or it might be necessary to deduct a small per cent. for the increased weight.

The two classes of shirtings are both largely white, with some color in warp and filling. They are estimated to lose two per cent. on account of the large amount of bleached cotton.

33″ Shirting, 294,000 lbs. + 2 per cent. = 300,000 lbs.
28½″ Shirting, 98,000 lbs. + 2 per cent. = 100,000 lbs.

The next class of goods, as will be noted later, has the same organization as the narrow shirting, but it is woven entirely of heavily colored yarns. To adjust this accession of weight, we deduct three per cent. from the pounds of finished cloth.

41,200 lbs. – 3 per cent. = 40,000 lbs.

The last cloth is a fancy woven flannel with a double face, napped on both sides. It is of both white and colored yarn, but experiment has shown that there is a loss of about two per cent. in finishing on the nappers. We therefore add two per cent. to the reported weight of the cloth packed in cases.

19,600 lbs. + 2 per cent. = 20,000 lbs.

	Mark.				Corrected yds. pr. lb.
Staples,	SG	800,000 lbs.		800,000	6.50
Dress Styles,	DP	206,000 "	– 3 per cent. =	200,000	6.50
33″ Shirting,	33″S	294,000 "	+ 2 per cent. =	300,000	4.80
28½″ Shirting,	28″S	98,000 "	+ 2 per cent. =	100,000	5.17
Columbian Cloth,	CC	41,200 "	– 3 per cent. =	40,000	5.16
Double Flannel,	DF	19,600 "	+ 2 per cent. =	20,000	2.84
		1,458,800		1,460,000	

The account of cotton used, and stock in process is as follows. The latter is taken at the value of the cotton, plus the labor and expense that have been bestowed upon it, in each room which it has passed through.

Cotton on hand, July 1, 1898,	1,130,820 lbs.	at 6.70	$75,764.94
Stock in process, July 1, 1898,	320,175 "		50,907.83
	1,450,995 "		$126,672.77
Cotton purchased to Jan. 1, 1899,	2,840,680 lbs.	at 6.10	$173,281.48
	4,291,675 "		$299,954.35

ON HAND, Dec. 31, 1898.				
Cotton	2,249.905 lbs. at 6.10		$137,244.20	
In process	302,670 lbs.	2,552,575	45,900.50	183,144.70
Cotton used in six months,		1,739,100		$116,809.55
Goods produced,		1,460,000		
Gross waste, 16.4%		279,100		
Waste sold, 11.7%		197,362		4,672.38
Waste unaccounted for, 4.7%		81,738		$112,137.17

Net cost of cotton, $112,137.17.

Net cost of cotton, per pound of cloth, 7.68 cents.

Only one grade of cotton is used for all goods.

The other expenses of manufacturing are:

Carding,	$11,946.44
Spinning,	14,165.20
Spooling,	3,876.48
Reeling,	240.00
Warping,	2,153.60
Beaming,	6,068.70
Chain Quilling,	4,315.26
Skein Quilling,	800.00
Dressing and Drawing in,	7,267.40
Weaving,	97,324.55
Pattern Room, etc.,	1,684.20
Finishing,	9,299.04
Dye House labor,	10,860.10
Total Manufacturing Labor,	$170,000.97

General expense:		
Salaries, Office expense, etc.,		$5,160.80
Freight on goods,		1,106.20
Dyes and Chemicals,		24,144.30
Steam, Power and heat	$17,425.50	
Steam, Dye House,	3,000.00	
		20,425.50
Packing Cases, etc.,		6,875.10
Starch,		2,750.08
Gas,		1,210.02
Oil,		661.15
Insurance,		825.00
Taxes,		6,647.45
Fancy Yarns,		26.00
New Machinery,		11,000.00
Repairs on Machinery,		17,500.00
Repairs on Buildings,		16,000.00
Watch and Yard,		12,100.00
		$126,431.00

The labor costs in this mill are determined from weekly reports. Each department, excepting the Dye house, renders to the office, a weekly report of the machinery run, the amount of work produced, the amount of wages paid, and the cost per pound for the department on each kind of product.

Samples of the reports from each room are given here, with a description of the method of making.

CARDING ROOM REPORT.

Cost per pound of roving for week ending Dec. 3, 1898.

Hank of Roving,	3.20	1.30
Fly Frame Spindles Run,	3,240	30
Pounds Roving Made,	55,600	1,000
Wages, Picking,	$ 40.50	$ .73
" Carding,	60.62	1.09
" Drawing Frames,	51.00	.92
" Slubbers,	32.45	.50
" Int. Frames,	52.66	.80
" Fly "	110.62	1.02
" Jack "		
" Day hands "	12.40	.22
" General,	69.80	1.26
" Total,	$430.05	$6.54
Cost per Pound,	.774	.654

JOHN SMITH, Overseer.

The entries above, represent the actual wages paid for each operation. Those for picking, carding and drawing, are divided between the two kinds of roving, in proportion to the pounds of roving made.

SPINNING ROOM REPORT.

Cost per pound of yarn spun for week ending, Dec. 3, 1898.

No. of Yarn,	25 Warp	25 Fill.	10 Fill.
Spindles Run,	28,000	9,540	312
Pounds Yarn Spun,	41,500	13,800	980
Wages, Spinners,	$184.00	$72.84	$5.17
" Doffers,	74.70	39.43	2.85
" Steamers,		9.20	
" Trucking,		5.80	.50
" General Room Expense,	93.80	32.13	1.04
" Total,	$352.50	$159.40	$9.56
Cost per Pound,	.85	1.16	1.00

JAMES BROWN, Overseer.

The spinners, doffers and steamers wages entered in the foregoing report, are the amounts paid for each kind, warp and filling. The General Room Expense is divided according to the *spindles run* on *each* kind, on the principle that an equal amount of care and oversight is necessary, whether a spindle run on 10s, producing four pounds, or on 25s producing two pounds or less.

The wages on Roving Frames are divided according to the actual amount paid for each class of work. The day hands about the frames, roving carriers, etc., are divided according to the pounds produced, as is also the general room expense, which comprises the overseer, second hand, sweepers, etc.; all hands not fairly assignable to any single operation. By right, the expense should be divided in proportion to the fly frame spindles run, but this is frequently impracticable, owing to roving made in two processes on frames, and other reasons.

REPORT OF SPOOLING AND WARPING.

Cost per pound of yarn spooled and warped, week ending Dec. 3, 1898.

	SPOOLING.		WARPING.
No. of Yarn,	25		25
Machines Run,			
Pounds Done,	41,000		41,200
Wages, Spoolers,	$121.82		
" Day Help,	13.56		
" Ball Warpers,			$50.26
" Day Help,			19.52
General Room Expense,	12.62		12.62
Total Wages,	$148.00		$82.40
Cost per Pound,	.36		.20

FRED JONES, Overseer.

The wages paid spoolers and warpers, are entered in their respective columns, the day help assigned to the operations

which they assist, and the general room expense divided in this case, equally between the two.

BEAMING AND CHAIN QUILLING ROOM.

Cost per pound of work done, week ending Dec. 3, 1898.

Kind of Goods,	SG	DP	33″S	28″S	CC	25 Yarn.
Full Chains Run,	120	32	48	14	5	106
Ponnds Done,	15,000	4,000	6,000	1,800	700	13,300
Wages, Splitting,		$ 4.20	$ 5.50	$ 1.80	$ .60	
" Beaming,	$99.14	34.56	39.20	11.60	5.75	
" Others,	3.00	.88	1.12	.36	.14	
" Chain Quilling,						$120.72
" Doffing,						18.16
" Others,						10.03
General Room Expense,	10.36	3.96	4.58	1.44	.64	15.11
Total Wages,	$111.50	$43.60	$50.40	$15.20	7.13	$164.02
Cost per Pound,	.74	1.09	.84	.90	1.02	1.23

J. HENRY, Overseer.

This is the first report, in which the wages are entered on the report under the headings dividing the goods into the different classes. Previously there has been only roving or yarn to handle. In this room the division is accomplished by the following means. At the beginning of each week, there is issued to each beamer, a card printed on one side, in the accompanying form, having a blank line at the top for his name, and the date, columns for each work-day in the week, and lines for each half hour, during the working day.

Whenever a chain is given a beamer, a hole is punched through the ticket, on the line representing the nearest half hour, and in the column which indicates the day of the week. On the back of the ticket, which is plain, and close by the punched hole, the beamer writes the mark, showing the kind of goods for which the chain is to be used, as SG, 28″S, or otherwise as the case may be. This mark he obtains from the usual ticket accompanying the chain. It will be noticed that the cost

of beaming on some goods, greatly exceeds that on others, owing to the making of stripe beams, formed of two or more chains of different colors. The punches used on the ticket are similar to those employed by railroad conductors, and for beams of two chains, where the job price is different, a punch with a different shape of hole is used. At the end of the week, these tickets are returned to the overseer.

BEAMING ROOM.

Week ending, _____

	M.	T.	W.	T.	F.	S.
6.30						
7.00						
.30						
8.00						
.30						
9.00						
.30						
10.00						
.30						
11.00						
.30						
1.00						
.30						
2.00						
.30						
3.00						
.30						
4.00						
.30						
5.00						
.30						
6.00						

It is very easy on the back of the ticket, to count the number of beams run, observe the price by the shape of the holes, and make up the pay-rolls and the cost reports. Overseers who have used these tickets report that it is very difficult to make false reports, or insert any work not done, as it shows a break in the regularity of the holes.

Similar tickets are used for other piece work, as spooling, chain quilling, etc.

The cost of splitting, and chain quilling including doffing, is also entered on the cost report, in the places assigned. The general room expense, is here divided in the same proportion, as the total wages paid on each operation or class of goods, on the principle that the expense of overseeing may be fairly divided, in the ratio of the employees to be looked after, roughly represented by the wages paid. In a department where a variety of operations is carried on, this is usually a very equitable manner of solving the problem of how to divide the room expense.

REELING AND CHAIN QUILLING ROOM.

Cost per pound, week ending Dec. 3, 1898.

No. of Yarn,	25		25	
Frames Run,				
Pounds Done,	1,000		1,200	
Wages, Reeling,	$5.30			
" Bundling,	.70			
" Others,				
" Quilling,			$18.97	
" Others,			6.80	
" General Expense,	1.30		5.20	
Total Wages,	$7.30		$28.41	
Cost per Pound,	.73		2.41	

JOHN ROBINSON, Overseer.

In this room, the general room expense is divided according to the wages paid on each operation.

DRESSING AND WEB DRAWING REPORT.

Cost per pound for week ending Dec. 3, 1898.

Kind of Goods,	SG	DS	33″S	28″S	CC	DF
Beams Done,	181	52	57	23	26	6
Pounds Done,	14,700	4,200	5,600	1,800	1,700	450
Slasher Tenders,	$25.50	$10.50	$21.32	$ 8.75	$9.30	$1.00
" Helpers,		2.00	2.00	.75	1.25	
Other Hands,	2.26	1.50	2.00	.75	1.00	.50
Drawing In,	27.40	18.87	42.26	13.60	21.61	6.31
Twisting In,	7.80					
Harness Hands, Cotton,	2.90	1.00	1.00	.50		
" " Wire,		1.76	4.00	1.00	3.25	1.25
Other Hands,						
General Expense,	16.46	8.91	18.14	6.33	4.05	.48
Total Wages,	$82.32	$44.54	$90.72	$31.68	$40.46	$9.54
Cost per Pound,	.56	1.06	1.62	1.76	2.38	2.12

WM. DRESSER, Overseer.

The dressing room cost report has the slasher tenders wages entered in their proper spaces, divided according to the time spent on each kind of goods. The other men about the slashers, and the hands employed on harnesses, are divided according to the judgment of the overseer. The drawing-in is from the tickets returned by the web drawers, and is the same as the pay-roll is made up from. The general room expense is divided according to the wages paid on each class of work.

All the reports given thus far, have to do with the yarn, in preparation for weaving, and in making up the costs of goods, they are combined in the manner now to be described.

For each organization and mark of goods, a blank named the "Organization Sheet" is prepared, such as follows, in which the data at the top are first filled in. The yards per pound are the corrected yards, obtained by dividing the yards produced, corrected by addition for the loss in napping, gain in dyeing, etc.

The per cent. warp and filling are necessary at this point, and are obtained by the following rule: Divide the ends in the warp by the number of the warp yarn. Multiply the picks per inch

by the width of the finished cloth, and divide the product by the number of the filling yarn. Divide the first quotient by the sum of the two quotients, and the result will be the per cent. of the cloth which is warp. The remainder of course is filling.

The totals of work done, in machinery run, and wages paid, with the cost per pound on each kind of product from the weekly cost reports for six months, are posted to a book, suitably ruled to exhibit each room by itself, and to be easily added. By comparing the results, week after week, it will be seen that there is a certain amount of variation in the cost per pound, etc.

At the end of the six months, the total wages paid, may be divided by the pounds done to obtain the average cost. Unless, however, the total pounds reported done, agree with the actual pounds done and the total wages agree with the pay-roll, there will be necessary a correction for the discrepancy. As changes in pay-rolls, as made up by overseers are not unknown, and as there is no way to foretell what waste may be made on the operations, succeeding the one under examination, this correction is always necessary, though often times it proves small. The discrepancy in wages should not exceed one per cent.

In order to make this correction, a table is prepared to show the amount of each kind of yarn used in each class of goods, and the manner of preparation. This table must be made up from the organization of the goods, the totals of the weekly reports, and a knowledge of the conditions in the mill, from time to time.

The following considerations will assist in the making of this table: The SG are one half white, both in filling and warp. All white filling is spun on filling bobbins, from cotton bleached in the raw stock. No white filling is used in DP or CC. All the filling of DF is spun on frames, from colored, white or mixed stock. The proportion of white in the 33″ and 28″ is known. The filling from skein yarn is not required in SG, DF, nor CC, and there are means of knowing approximately, how much of this is used in each of the other classes.

MARKS	Pounds Produced.	Per Cent. Warp.	Per Cent. Filling.	Pounds Warp.	Pounds Filling.	Spun on W. Frames.	Spun on Fill. Frames.	Spooled and Warped.	Reeled and Quilled.	BEAMED.	Quilled from Chains.
SG	800,000	51	49	408,000	392,000	608,000	192,000	608,000		408,000	200,000
DP	200,000	51	49	102,000	98,000	200,000		186,000	14,000	102,000	84,000
33″	300,000	50	50	150,000	150,000	195,000	105,000	180,000	15,000	150,000	30,000
28″	100,000	47	53	47,000	53,000	60,000	40,000	57,000	3,000	47,000	10,000
CC	40,000	47	53	18,800	21,200	40,000		40,000		18,800	21,200
DF	20,000	29	71	5,800	14,200	5,800	14,200	5,800			
	1,460,000			731,600	728,400	1,108,800	345,200	1,076,800	32,000	725,800	345,200

Only one sample of each of the cost reports is shown, but the sum of all those from the card room shows:

1,482,890 lbs. 3.20 hank roving made, costing,	$11,729.49
14,560 lbs. 1.30 hank roving made, costing,	90.61
1,497,450 lbs.	$11,820.10

From the preceeding table, it is plain that by the time this had been worked into cloth, it had been reduced to 1,460,000 pounds of cotton in the goods sold, divided into 14,200 pounds, of number 10 yarn from 1.30 hank roving, and 1,445,800 pounds of 25 yarn, from 3.20 hank roving. From the expenses of manufacturing we find the exact amount of the card room pay-roll to be $11,946.44. This amount we will therefore divide into two amounts, having the same ratio to one another, as the *reported* costs of the two kinds of roving. By proportion,

$11,820.10 : $11,946.44 :: $11,729.49 : $11,855.56

and

$11,820.10 : $11,946.44 :: $90.61 : $90.88

We find therefore

1,445,800 lbs. of 3.20 cost	$11,855.56	or .82 cents per lb.
14,200 lbs. of 1.30 cost	90.88	or .64 cents per lb.

In a similar way, the summary of reports from each room must be corrected to the actual pounds done, and the exact cost as finally rendered from the pay-rolls.

There is a liability of this correction, being abnormally large if the amount of yarn in process is increased at the end of the six months, over what it was in the beginning. In some mills, it is the custom not to determine this adjustment every six months, but to add a percentage ascertained at some time to be correct for each room, to the average cost.

Conforming the totals of the room reports, to the semi-annual statement of the office account, we have the following additional data:

SPINNING.

1,108,800 lbs.	No. 25 Warp,	cost,	$9,979.20	=	.90	cents	per	lb.
337,000 "	25 Filling,	"	4,044.00	=	1.20	"	"	"
14,200 "	10 "	"	142.00	=	1.00	"	"	"
1,460,000 "			$14,165.20					

SPOOLING.

1,076,800 lbs. No. 25 Warp, cost, $3,876.48 = .36 cents per lb.

REELING.

32,000 lbs. No. 25 Warp, cost, $240.00 = .75 cents per lb.

WARPING.

1,076,800 lbs. No. 25 Warp, cost, $2,153.60 = .20 cents per lb.

BEAMING.

408,000 lbs.	SG	cost	$3,060.70	=	.75	cents	per	lb.
102,000 "	DP	"	1,122.04	=	1.10	"	"	"
150,000 "	33″S	"	1,275.00	=	.85	"	"	"
47,000 "	28″S	"	423.00	=	.90	"	"	"
18,800 "	CC	"	188.00	=	1.00	"	"	"
725,800			$6,068.70					

CHAIN QUILLING.

345,200 lbs. No. 25 Yarn, cost, $4,315.26 = 1.25 cents per lb.

SKEIN QUILLING.

32,000 lbs. No. 25 Yarn, cost, $800.00 = 2.50 cents per lb.

DRESSING AND DRAWING IN.

408,000 lbs.	SG	cost,	$2,321.10	=	.57	cents	per	lb.
102,000 "	DP	"	1,102.04	=	1.08	"	"	"
150,000 "	33″S	"	2,431.06	=	1.62	"	"	"
47,000 "	28″S	"	839.90	=	1.79	"	"	"
18,800 "	CC	"	448.12	=	2.38	"	"	"
5,800 "	DF	"	125.18	=	2.16	"	"	"
731,600			$7,267.40					

It will be seen that on the lower part of each organization sheet, there is arranged a blank space, for making up the labor cost as far as weaving. The cost per pound of each operation is now ready to use in these blanks. Beginning with the staple ginghams, the cost per pound for carding 25 warp is .82 cents per pound, the per cent. of the cloth which is warp and carded at this price is 51 per cent. This is also the cost of carding for the filling, which is of the same size yarn, and 49 per cent. of the cloth is filling. All the cloth being carded at the same price, the cost of carding warp and filling may be united in one sum .82 cents per pound of cloth.

The cost of spinning 25 warp is .90 cents per pound, and all the warp, *i. e.* 51 per cent. of the cloth is so spun. .90 x 51 per cent =.459 cents per pound of cloth. Of the filling, 200,000 pounds out of 800,000 pounds of cloth are spun on warp frames. This is 25 per cent. of the cloth which will be the per cent. operated on. .90 x 25 per cent. =.225 cents per pound. There are also 192,000 pounds of filling, spun on the filling frames. This is 24 per cent. of the cloth, spun at a cost per pound for the operation of 1.20 cents per pound. 1.20 x 24 per cent. =.288 cents per pound of *cloth*. We observe that 51 per cent. plus 25 per cent. or 76 per cent. of the cloth is spooled at a cost for spooling of .36 cents per pound. .36 x 76 per cent. =.274 cents per pound of cloth. The same per cent. of the cloth is warped at a cost per pound for warping of .20 cents. .20 x 76 per cent. =.152 cents per pound of cloth. All the warp or 51 per cent. of the cloth is beamed at a cost per pound for beaming staples of .75 cents. .75 x 51 per cent. =.383 cents per pound of cloth. 25 per cent. of the cloth is filling, quilled from chains, at a cost of 1.25 cents per pound for quilling. 1.25 x 25 per cent. =.312 cents per pound of cloth. 51 per cent. of the cloth is dressed at a cost for dressing of .57 cents. .57 x 51 per cent. =.291 cents per pound of cloth.

Inserting the costs per pound of cloth in the column provided, and adding them together, we make 3.204 cents the cost for all labor on staple ginghams up to weaving.

Filling in the cost per pound and the per cent. operated on, in each of the organization sheets, and computing the extensions, we arrive at the following results:

STAPLES.

Warp, 1500 ends, No. 25 yarn, from 3.20 hank roving.
Filling, 52 picks, No. 25 yarn, from 3.20 hank roving.
Width, 27 inches, 6.50 corrected yards per lb.
Per cent. Warp, 51%.
Per cent. Filling, 49%.

OPERATION.	Cost Per Lb.	Per Cent. Operated On.	Cost per Lb. Cloth.
Carding, Warp	.82	51	.820
" Filling	.82	49	
Spinning, Warp	.90	51	.459
" Filling	.90	25	.225
" "	1.20	24	.288
Spooling, Warp	.36	51	
" Filling	.36	25	.274
Warping Warp	.20	51	
" Filling	.20	25	.152
Beaming, Warp	.75	51	.383
Dressing, Filling	.57	51	.291
Ch. Quilling, Filling	1.25	25	.312
			3.204

DRESS STYLE GINGHAMS.

Warp, 1500 ends, No. 25 yarn, from 3.20 hank roving.
Filling, 52 picks, No. 25 yarn, from 3.20 hank roving.
Width 27″, 6.50 yards per lb.
Per cent. Warp, 51%.
Per cent. Filling, 49%. Chain, 42%. Skein, 7%.

OPERATION.		Cost per Lb.	Per Cent. Operated On.	Cost per Lb. Cloth.
Carding,	Warp	.82	51	.820
"	Filling	.82	49	
Spinning,	Warp	.90	51	
"	Filling	.90	49	.900
"	"	1.20	0	
Spooling,	Warp	.36	51	.184
"	Filling	.36	42	.151
Warping,	Warp	.20	51	.102
"	Filling	.20	42	.084
Beaming,	Warp	1.10	51	.561
Chain Quilling,	Filling	1.25	42	.525
Reeling,	"	.75	7	.053
Skein Quilling,	"	2.50	7	.175
Dressing,	Warp	1.08	51	.551
				4.106

SHIRTING 33″.

Warp, 2,100 ends, No. 25 Yarn, from 3.20 hank roving.
Filling, 62 picks, No. 25 Yarn, from 3.20 hank roving.
Width, 33″, 4.80 corrected yards per lb.
Per cent. Warp, 50.
Per cent. Filling, 50; 35% frame, 10% chain, 5% skein.

Operation.		Cost per Lb.	Per Cent. Operated On.	Cost per Lb. Cloth.
Carding,	Warp	.82	50	.820
"	Filling	.82	50	
Spinning,	Warp	.90	50	.450
"	Filling	.90	15	.135
"	"	1.20	35	.420
Spooling,	Warp	.36	50	.180
"	Filling	.36	10	.036
Warping,	Warp	.20	50	.100
"	Filling	.20	10	.020
Beaming,	Warp	.85	50	.425
Chain Quilling,	Filling	1.25	10	.125
Reeling,	"	.75	5	.037
Skein Quilling,	"	2.50	5	.125
Dressing,	Warp	1.62	50	.810
				3.683

SHIRTING 28½″.

Warp, 1,800 ends, No. 25 Yarn, from 3.20 hank roving.
Filling, 64 picks, No. 25 Yarn, from 3.20 hank roving.
Width, 28½″, 5.17 corrected yards per lb.
Per cent. Warp, 47.
Per cent. Filling, 53; 40% frame, 10% chain, 3% skein.

Operation.		Cost per Lb.	Per Cent. Operated On.	Cost per Lb. Cloth.
Carding,	Warp	.82	47	.820
"	Filling	.82	53	
Spinning,	Warp	.90	47	.540
"	Filling	.90	13	
"	"	1.20	40	.480
Spooling,	Warp	.36	47	.169
"	Filling	.36	10	.036
Warping,	Warp	.20	47	.094
"	Filling	.20	10	.020
Beaming,	Warp	.90	47	.423
Chain Quilling,	Filling	1.25	10	.125
Reeling,	Filling	.75	3	.022
Dressing,	Warp	1.79	47	.841
Skein Quilling,	Filling	2.50	3	.075
				3.645

FANCY DRESS GOODS. COLUMBIAN CLOTH.

Warp, 1,800 ends, No. 25 Yarn, from 3.20 hank roving.
Filling, 64 picks, No. 25 Yarn, from 3.20 hank roving.
Width, 28½″ 5.16 corrected yards per lb.
Per cent. Warp, 47.
Per cent. Filling, 53. All chain.

Operation.		Cost per Lb.	Per Cent. Operated On.	Cost per Lb. Cloth.
Carding,	Warp	.82	47	.820
"	Filling	.82	53	
Spinning,	Warp	.90	47	.900
"	Filling	.90	53	
Spooling,	Warp	.36	47	.360
"	Filling	.36	53	
Warping,	Warp	.20	47	.200
"	Filling	.20	53	
Beaming,	Warp	1.00	47	.470
Chain Quilling,	Filling	1.25	53	.663
Dressing,	Warp	2.38	47	1.119
				4.532

DOUBLE FLANNEL.

Warp, 1,800 ends, No. 25 Warp Yarn from 3.20 hank roving.
Filling, 63 picks, No. 10 Filling Yarn from 1.30 hank roving.
Width, 28″, 2.84 corrected yards per lb.
Per cent. Warp, 29, Gray Yarn.
Per cent. Filling, 71. Frame spun.

Operation.		Cost per Lb.	Per Cent. Operated On.	Cost per Lb. Cloth.
Carding,	Warp	.82	29	.238
"	Filling	.64	71	.454
Spinning,	Warp	.90	29	.261
"	Filling	1.00	71	.710
Spooling,	Warp	.36	29	.104
"	Filling	0	0	
Warping,	Warp	.20	29	.058
"	Filling	0	0	
Dressing,	Warp	2.16	29	.626
				2.451

The next portion of manufacturing cost to which we give attention, is coloring. The expense is made up of these items, previously given:

Dye stuffs, etc.,	$24,144.30
Dye House Labor,	10,860.10
Dye House Steam,	3,000.00
	$38,004.40

The overseer of dyeing makes up, carefully, an estimate of the cost of dyeing each color in use in the mill, and at the office at the end of the six months, there is made up an account of the yards of each pattern of each kind of goods produced. From the ends and picks of each color, in conjunction with this report a statement of the pounds of yarn of each color, necessary to fabricate each class of goods, is made up, and multiplied by the estimated cost of dyeing that color. The total estimated costs of coloring for each class of goods, added together should make the total reported cost of coloring. This must be corrected to the actual cost above given. On this semi-annual account the per cent. to be added is 4.23.

DIVISION OF COLORING.

STAPLES.

204,000 lbs. Warp, bleached chain, at	.90	=	$1,836.00
192,000 " Filling, " cotton, at	.95		
Add for waste carding,	.05		
	1.00	=	1,920.00
280,000 " W. and F. Blue,	4.10	=	11,480.00
100,000 " " " " Brown,	4.60	=	4,600.00
24,000 " " " " Black,	4.33	=	1,040.00
			$20,876.00
Add 4.23%			883.05
Corrected cost of coloring Staples,			$21,759.05
Corrected cost per pound of goods	2.72 cts.		

Similarly, the cost of other classes of goods is as follows:

DP	$7,260.00 or 3.63	cents per lb. of goods.
33″	5,400.00 or 1.80	" " " " "
28″	1,920.00 or 1.92	" " " " "
CC	1,337.96 or 3.345	" " " " "

DOUBLE FLANNEL, FILLING ONLY.

4,000 lbs.	Dark Blue,		at 3.15	$126.00
2,000 " Mix $\frac{1}{5}$	Dark Brown=400 lbs.			
	400 pounds at	6.00		
	Add 5% for waste,	.30	at 6.30	25.20
2,000 "	Dark Green,		5.25	105.00
3,000 "	Light Blue,		1.93	57.90
3,200 "	Not colored,			
				$314.10
	Add 4.23%			13.29
Total corrected cost,				$327.39
Total corrected cost per pound, 1.637 cents.				

The next expense to be divided is weaving, which cost $97,-413.81. Each week there is a cost report from the weave room, which furnishes the basis for the division of the sum total.

The report is similar to those from the other rooms, and is made up as given below. The wages paid for piece work, on each kind of goods, forms the first item in the report. The wages paid fixers, are divided according to the data, in the knowledge of the overseer. Filling hands' wages are divided pro rata to the number of looms on each kind of goods, on the principle that they must serve every loom alike. Inspectors are divided according to the amount of work necessary, as are also, the wages paid miscellaneous help. The general room expense, including overseer, second hand, sweepers, etc., are divided according to the looms employed on each class of work.

The amount paid weavers and others, is greater on the more difficult work, as the CC and shirtings. The latter also require a closer inspection.

The weave room costs, after the necessary corrections, stand as follows, for the six months,

SG	$44,816.12	or	5.602	cents	per	pound.
DP	15,442.20	"	7.721	"	"	"
33″S	23,133.47	"	7.711	"	"	"
28″S	8,204.36	"	8.204	"	"	"
CC	4,528.40	"	11.321	"	"	"
DF	1,200.00	"	6.000	"	"	"
	$97,324.55					

WEAVING ROOM REPORT.

Cost per pound for weaving, week ending, Dec. 3, 1898.

Kind of Goods,	SG	DP.	33″ S	28″ S.	CC.	DF
Looms run,	870	300	350	130	66	24
Pounds done,	30,450	7,700	11,540	3,850	1,520	1,000
Cuts woven,	4,502	1,157	946	480	274	67
Wages, Weavers,	1,479.13	510.70	705.10	252.90	131.60	49.50
" Section Hands,	121.22	51.20	71.20	30.10	15.08	6.10
" Filling " &c.	62.64	21.60	25.20	9.36	4.74	1.72
" Inspectors,	18.00	9.00	24.30	8.00	1.80	.50
" Others,		5.00	32.00	10.50	5.00	1.00
" Gen. Room Ex.	30.45	10.50	12.25	4.55	2.31	.84
Wages, Total,	1,711.44	608.00	870.05	315.41	160.53	59.66
Cost per pound,	5.617	7.896	7.540	6.193	11.570	5.966

RICHARD WEAVER, Overseer.

The finishing room also reports the work done, but the cost is based on the *yards* put out, rather than the pounds, and they are divided only into as many classes, as have different methods of finish. The staples and dress style ginghams have the same finish, and are classed together, the 28 and 33 inch shirtings and the CC all pass through the same processes in finishing, and are included under one head, for it will take as long to wash, tenter, calender, inspect and wind one yard of 28 inch goods, as of 33 inch goods. The cost is therefore based on the yards finished.

In the finishing room the sample cards are made and an account of this labor is kept, and affords a means for dividing the wages. A sample report follows:

FINISHING ROOM REPORT.

Cost per yard for finishing, week ending Dec. 3, 1898.

Kind of goods,	Ginghams.	Shirtings, CC	Flannel.
Yards finished,	246,000	84,460	3,540
Cuts finished,	5,466	1,728	68
Wages, Shearing,	34.56	12.20	
" Singeing,		4.50	
" Washing,		15.64	
" Tentering,	23.80	15.87	
" Calendering, " Folding, etc. " Inspecting,	66.68	69.52	1.20
" Pressing,	6.20	3.60	.35
" Packing,	19.70	8.90	.30
" Napping,			9.00
" Card making,	15.60	7.63	1.80
" Others,			
" General Room Expenses,	20.82	17.23	1.58
Total,	187.36	155.09	14.23

T. WALKER, Overseer.

The six months finishing account from the sum of these reports for the six months, corrected to exactly agree with the pay-roll in the office, stand as follows:

Total cost of finishing Ginghams,	$4,978.76
" " " " Shirtings,	4,092.60
" " " " Flannel,	227.68
	$9,299.04

The cost of finishing ginghams is divided between the staples and dress styles, in proportion to the yards of each:

Total,	6,500,000 yds.	$4,978.76	
Staples,	5,200,000 yds.	3,983.01	= .497 per lb.
Dress Styles,	1,300,000 yds.	995.75	= .498 per lb.

The cost of finishing shirtings is divided among the various kinds, according to the yards of each:

Total,	2,164,000 yds,	$4,092.60	
33″	1,440,000 "	2,724.50	= .908 per lb.
28″	517,000 "	977.76	= .978 " "
CC	206,400 "	390.34	= .976 " "

The expense of the designing room for the six months is $1,-684.20. Each employee in the room fills out, each week, a report:

PATTERN ROOM TIME REPORT.

Time of Peter Treadler for the week ending, Dec. 3, 1898.

	Ginghams.	Dress Goods.	Shirting.	Flannel.
Monday,	10-½			
Tuesday,	10-½			
Wednesday,	5-½	5		
Thursday,			10-½	
Friday,			10-½	
Saturday,			5 ½	
Total hours.	26-½	5	26-½	

At the close of the six months, the time of the reports is summarized, and multiplied by the rates per hour. The oversight of the room divided in proportion to the labor spent, and added to it.

For the six months just passed, these were the results:

Ginghams, DP,	$483.00	or	.242	cents per lb.
Shirtings,	828.60	"	.207	" " "
Dress Goods,	276.00	"	.690	" " "
Flannels,	96.60	"	.483	" " "
	$1,684.20			

All the labor involved in the productive part of manufacturing has been apportioned to the various classes of goods, in which it was employed. Also the cost of dyestuffs, and steam consumed in coloring. There remain those outlays commonly termed general expense, including fixed charges, supplies, power, etc. These are now divided into two classes. First, those which are changed by a change in the output of the mill, which would be enlarged if by any change in the class of goods made, the production of the present plant were increased, and reduced if the nature of the product were so altered as by the production of finer goods—as to decrease the weight of goods invoiced.

Among these we class:

Packing cases,	$6,875.10
Starch for sizing warps, and for finished goods,	2,750.08
Freight on goods to points where same are stored or delivered,	5,160.80
Steam for power for carding, spinning, etc., which would be unused to some extent, if the product of the mill, on goods of this number yarn were decreased by the making of goods of higher count, and vice versa. Two thirds of the remaining steam account,	11,617.00
	$26,402.98

This amount we divide evenly among the pounds produced: $26,402.98÷1,460,000=1.808 cents per pound.

This cost *per pound* would remain about the same under any circumstances. It will be noticed that all of these classes of goods, but one, are made from number 25 yarn. And that the varied rates of production, stated a little later, depend upon the organization and width of the cloth, and the number of colors in the pattern. The cost per pound for carding and spinning this yarn would be the same, into whichever class of goods the yarn was put. A large proportion of the motive power of the mill is required in these two departments, and a corresponding proportion of the expense should be divided evenly among the pounds produced. More cloth made, means more starch used,

more cases to pack in, more freight to pay. But the cost per pound would be nearly constant. On the other hand the remaining charges, with the exception of fancy yarns, which are used in and chargeable to the double flannels only, are nearly constant in their sum total, and variable in cost per pound according to the output of the mills. Some of them would remain though the mill were stopped entirely, as taxes, insurance and watch. Others vary more or less, as salaries, oil or repairs, but their amount is not to a great extent dependent upon the exact production, provided only the mill is kept running.

These charges are therefore apportioned to each class of goods as nearly as possible to what they would be, if the whole mill were on the class under consideration. As the last productive machine is the loom, the cost per pound depends upon the production of the loom. Or the charge is so much per loom, and if the loom turns off much cloth, the charge is relatively light; and if, on the other hand, the loom is on a complicated pattern, light and not to be rapidly produced, the cost per pound is relatively heavy. Mathematically speaking the cost will vary inversely to the pounds per loom woven.

These charges are:

Steam, one-third,	$ 5,808.50
Gas,	1,210.02
Oil,	661.15
Office expenses,	5,160.80
Insurance,	825.00
Taxes,	6,647.45
New machinery,	11,000.00
Repairs on machinery,	17,500.00
Repairs on buildings,	16,000.00
Watch and yard,	12,100.00
	$76,912.92

The following table provides the division of the general expense. The second column is the pounds produced per loom per week, found by dividing the total pounds of each kind of goods, by the sum of the average number of looms run each week, on that mark, for the twenty-six weeks of the six

months. The next column contains amounts varying inversely to those in the second column, called the reciprocals of the numbers in the second column, and found by dividing one by these numbers. The fifth column contains the pounds produced, multiplied by the reciprocals, a series of numbers varying in the same ratio as the amounts of the general expense chargeable to each mark of goods. Dividing the sum of these expenses by the sum of this column we have a unit .170,063 which multiplied by the numbers in the fifth column will give the amount of expense chargeable to each kind of goods set down in the sixth column. The last column contains the cost per pound.

Mark.	Pounds per loom per week.	Reciprocal.	Pounds Produced.	Product of Reciprocal and production.	General Expense Divided.	Cost per Pound.
SG	35	.286	800,000	228,800	38,910.55	4.864
DP	26	.386	200,000	77,200	13,128.90	6.564
33″S	33	.303	300,000	90,900	15,458.78	5.153
28″S	30	.333	100,000	33,300	5,663.10	5.663
CC	23	.435	40,000	17,400	2,959.10	7.398
DF	43	.233	20,000	4,660	792.49	3.962
				452,210	76,912.92	

76,912.92 ÷452,260=.170063.

We have now divided and assigned all the expenses of manufacturing at the mill. These costs per pound may now be assembled to obtain the gross results. This is conveniently done in a table as below, in which the first column shows the titles of the divisions of expense. The second the full sum expended in each division, and the remainder of the colums, in pairs, show how each expense account has been divided among the various classes of goods, and the cost per pound which it makes for each class. The totals show the full expense for each kind of goods, the full cost per pound at the mill, and on another line is given the cost per yard, obtained by dividing the full expense for each kind by the yards produced. These are the figures sought in all the foregoing analysis and division of expense.

	Totals.	Staples.		Dress Styles.		33 inch Shirting.		28 inch Shirting.		Columbian Cloth.		Flannel.	
Corrected Pounds,	1,460,000	800,000		200,000		300,000		100,000		40,000		20,000	
Yards,	8,720,240	5,200,000		1,300,000		1,440,600		517,000		206,400		56,840	
		Total Cost.	Per Lb. Cents.	Total Cost	Per Lb. Cents.	Total Cost.	Per Lb. Cents.	Total Cost	Per Lb. Cents.	Total Cost	Per Lb. Cents.	Total Cost,	Per Lb. Cents.
Cotton,	$112,137.17	$ 61,440.00	7.680	$15,360.00	7.680	$23,040.00	7.680	$7,680.00	7.680	$3,072.00	7.680	$1,536.00	7.680
Fancy Yarns,	26.00											26.00	.130
Labor, Carding and Dressing,	50,833.08	25,632.00	3.204	8,212.00	4.106	11,049.00	3.683	3,645.00	3.645	1,812.80	4.532	490.20	2.451
Labor, Weaving,	97,324.55	44,816.12	5.602	15,442.20	7.721	23,133.47	7.711	8,204.36	8.204	4,528.40	11.321	1,200.00	6.000
Labor, Finishing,	9,299.04	3,983.01	.497	995.75	.498	2,724.50	.908	977.76	.978	390.34	.976	227.60	1.138
Labor, Pattern Room,	1,684.20			484.00	.242	621.00	.207	207.00	.207	276.00	.690	96.60	.483
Coloring,	38,004.40	21,759.05	2.720	7,260.00	3.630	5,400.00	1.800	1,920.00	1.920	1,337.96	3.345	327.39	1.637
General Expense, Per pound,	26,402.98	14,464.00	1.808	3,616.00	1.808	5,424.00	1.808	1,808.00	1.808	723.20	1.808	361.60	1.808
General Expense, Per Loom,	76,912.92	38,910.55	4.864	13,128.00	6.564	15,458.78	5.153	5,663.10	5.663	2,959.10	7.398	792.49	3.962
Total Cost,	$412,624.34	$211,004.73		$64,497.95		$86,850.75		$30,105.22		$15,099.80		$5,057.96	
Cost Per pound, cents,			26.375		32.249		28.950		30.105		37.750		25.289
Cost Per yard, cents,			4.058		4.961		6.029		5.823		7.316		8.894

There yet remains the satisfaction of proving the correctness of the mathematical operations, thus:

Cost of Staples,	$211,004.73
" " Dress Styles,	64,497.95
" " 33″ Shirting,	86,850.75
" " 28″ Shirting,	30,105.22
" " Columbian Cloth,	15,099.80
" " Flannels,	5,057.96
" " All Goods,	$412,616.41
Discrepancy from the mill account books,	7.93
	$412,624.34

Before the selling price of the goods is fixed, there should be added to the cost per yard, an amount sufficient to cover the expense of the treasurer's office, including interest, the commission on which goods are sold, and a margin for profits, determined by the capital stock of the corporation, the production of the mill, and not least of all, the condition of the market and the possibilities of the case.

The essential feature of the method just described, *viz.*: The cost reports from the departments as a basis, is applicable to every manufacturing department in a textile mill of any description, whether on print cloth, or a wide range of fabrics. But it is not therefore desirable to encumber any mill with such a harness, where no necessity for it exists. The labor and expense are unwarranted except there is such variety of work as to necessitate by some such system, the careful estimation of the division of labor as it is expended, and the insight and skill to make proper use of the memoranda.

The method just described is practicable, and within certain limits, reliable. By its use there is no danger of an account being made up far from the exact facts of the case, under ordinary circumstances, but it is easy to imagine a case, it is even unnecessary to imagine, for a large number of mills are today carrying on business in such variety, that the manner of dividing the general expense utilized in the foregoing, is unsatisfactory. The

principle involved in this manner of distributing the general expense is a valid one, namely that where *looms*, weaving various fabrics are under the same fixed charges, the measure of apportioning the said expense is in the ratio of the productions of the looms on the several fabrics. But when all general charges are divided upon this rule, it is open to the criticism that there is no proof that the fixed charges resting upon all other operations than weaving, are rightly divided in the same proportion. It will be seen that some of them are not, by the following table from the actual conditions in the same mill, where a loom on one cloth requires 29 spindles to supply it with yarn to make 58 pounds of cloth, while a loom beside it produced 133 pounds of cloth from 17 spindles, and a third loom wove 33 pounds of cloth with yarn from 31 spindles:

Mark.	Warp Yarn.	Filling Yarn.	Per Cent. Warp.	Lbs. per Spindle per Week.		Average Lbs. per Spindle per week.	Pounds per Loom per Week.	Spindles per Loom.
				Warp.	Filling.			
A	21	14	48	1.87	2.28	1.98	58	29.4
B	29	26	46	1.17	1.09	1.12	33	31.
C	12	2.50	33	4.09	14.00	7.71	133	17.2
D	21	5.50	30	1.87	7.77	3.91	136	34.9

It is also plain that in one room, two looms producing equal pounds per week, one white, one colored, are not fairly under the same conditions of general expense. Or if the one loom is on plain goods and another producing an equal amount of fancy woven goods, containing perhaps ply yarn, special filling of some sort, or other matter requiring expensive preparation, the general expense is not shared equitably, if divided evenly.

A certain mill was in the habit of dividing its general charges among all goods, under the average number system. The finer goods were made of yarns not spun at the mill, but purchased from other mills. Was it fair to include under the cost of making the finer goods a proportion of the full charges for oil, supplies, insurance, power, etc.? Were not the larger amounts of

these expenses, already included in the price of the yarn when bought? This practice compelled the finer goods to carry a burden rightly devolving on the coarser.

How shall the general expense be so analyzed and divided as to be distributed in a manner worthy of confidence as just and impartial, in a mill weaving fine and coarse goods, plain and fancy, buying and selling yarns, finishing some goods and selling others in the grey?

The consideration of these factors calls for another system of treatment than those already described, to be illustrated in a method to be explained at a later time.

The PRESIDENT. It is generally understood that the discussion of this paper is to be postponed until another meeting. We will pass from that to the topical questions.

108. What is the best way to keep mill hose for fire protection?

109. Are automatic sprinklers a necessity in the dust flues from pickers?

Mr. LOUIS SIMPSON. We have here two mill insurance friends who are well informed on these matters, and we were hoping that they would give us some advice. For myself, I find great difficulty in keeping our fire hose in anything like decent condition. When the inspector comes around he always gives the order, "Buy some more fire hose; buy some more fire hose." And fire hose these days, when rubber is so expensive, is a very important item. I would like to find some way in which fire hose could be made to last longer than a few months. As it is now, if the hose gets a little dirty or soiled, as it always does when used, we have to purchase new hose. At the same time, referring to the second question, we have automatic sprinklers in all kinds of places; places which anybody that has anything at all to do in a mill will know to be important, and places that we who are practical in mill work know to be unimportant; and I was hoping today that our two friends here would have spoken on these points. For myself, I have never seen the need of putting sprinklers in the dust flues providing the dust flues are properly made. But if by presence of this question amongst the topical questions we are to understand that the insurance companies are going to ask us by and by to put sprinklers in the dust flues, I think that we, who are the practical men in the mill, ought to get up and tell them straight that we do not approve of it. If it is meant by the dust chamber into which the dust goes after passing from the flue, I do not object to sprinklers being placed therein; but to put them into a well-made tin dust flue, to my mind, seems an unnecessary expense, and if our friends, the insurance people, are asking for that, they are,

in my opinion, playing into the hands of the makers of sprinklers, sales, rather than acting in their own or our interest.

The PRESIDENT. I presume these questions were propounded by some one, and I was in hopes that they would be defended by the parties who propounded them, at least. There does not seem to be anyone who cares to speak on them.

Mr. HENRY T. GRANT, Jr. I agree with Mr. SIMPSON that there is no necessity of sprinklers in dust flues. I have always recommended that a damper be put in a dust flue, and that the dust chamber itself be protected with automatic sprinklers. It seems to me that the dust flue itself is not a place for the introduction of a sprinkler. But I would suggest that our Secretary has had a long experience in that particular line and that his advice would be very pertinent.

Mr. C. J. H. WOODBURY. Mr. President, that is ancient history with me now, and after four or five years I do not assume to keep in touch with anything that has been so active in its progress as I presume that the fire protection of mills has been. Both those questions were sent me by members; I do not remember who; I never recollect who sends a topical question, for the personality of the propounder is supposed to be lost. But in regard to that question of the protection of the flues of picker rooms, there have been a great many fires which have been spread at once through a picker building of several stories by fire being sent down into the dust room from one picker, and then coming back through the dust flues into those pickers which are not in motion, or when the mill stops at noon or night, and spreading simultaneously in numerous places throughout the picker building. A great many years ago, in one of the cotton mills in Lowell, there were some dampers which were called differential dampers; that is to say, the dampers were not hung at the top to be opened by the force of the air, but they were hung a little out of the centre so that they were very nearly counterbalanced, and it was thought that they

presented a great deal less resistance to the egress of the air from the pickers than as if they were hung at the top. And it is a fact that under the old methods of protection and equipment, long before the automatic sprinklers, that this picker room of several stories had practical immunity from any fires extending throughout the building; the fires were all local. Afterwards automatic sprinklers were applied to dust flues. There were some patents and a great many suggestions and propositions of an automatic sprinkler especially to throw a sheet of water across the dust flue. I do not know that any of those were ever reduced to practice, either in practical form or in installation. The form of automatic sprinkler that was applied in a very few instances and asked for in a great many was, a hole some six or eight inches in diameter was cut in the top side of the dust flue and a concave piece of sheet metal similar to an overturned plate placed above it, giving in that manner enough space for a sprinkler to be placed so that it would not protrude beyond the inner line of the dust flue, the proposition being that it would in that way escape from being a hindrance. But in point of fact I have heard it alleged that the dust did catch on those sprinklers. The question, as I understood it, was as to the full measure of desirability of that form of protection.

Mr. LOUIS SIMPSON. Mr. President, in reference to that matter it would seem to me that in case of a fire, if all the machines were kept going there would be no chance whatever in this world for a fire to come back from the dust chamber into the room. I think in most of the modern mills today, if they were so unlucky as to have a fire in the dust chamber, the foreman has enough sense to keep his machines working. The great mistake is when they shut down the machines. I do not remember myself—they have the records and I have not—but in an experience of thirty years I have never known a fire to go back from the dust chamber to the machines. Of course cases may have occurred, but only when they stopped the machines.

Mr. JOHN E. PREST. Mr. SIMPSON stated he had never known a fire to go through the trunk back to the machine—is that the point?

Mr. LOUIS SIMPSON. Yes, I have not in thirty years. Such accidents may have occurred, but never to my knowledge.

Mr. JOHN E. PREST. I have had in my experience two or three cases of that kind; in fact, I had one only day before yesterday. The fire came through the dust trunk to the feeder, but it so happened that it did not do any damage; still the fire came through. On the same machine, I think, we had two fires, and the sprinkler put the fire out when it got to the feed box.

Mr. LOUIS SIMPSON. It came through the trunk against the wind?

Mr. JOHN E. PREST. It came through the trunk where the cotton passes through—goes through on a feeder into the gate box—and the sprinkler put it out.

Mr. LOUIS SIMPSON. That is not the question we are discussing. We are talking about dust flues, not about cotton conveyors.

Mr. JOHN E. PREST. The dust flue from the picker?

Mr. LOUIS SIMPSON. Yes, but you are talking about the conveyor, sir.

Mr. JOHN E. PREST. The dust flue from the picker to the dust chamber—is that the point?

Mr. LOUIS SIMPSON. Yes, that is the point. I quite grant that you may have fires in your conveyer, that is a different thing; but we were discussing fires which are said to occur in the flues that connect the air that is going *from* the machines into the dust chamber. As long as you keep the machines going, I

do not see how the fire will run against the air in a properly constructed flue.

Mr. JOHN E. PREST. We had a case a year ago where the fire passed through the dust flue into the chamber — the chamber below, which is all fire-proof down to the ground. We did not discover any fire, although it ran all the afternoon. Along in the evening smoke commenced to come up the flues, but there was no fire in the machine anywhere. We worked on that, putting the hose in there and washing it out thoroughly, and thought we had drowned it out and left it all right. We started the next day in the forenoon; it ran all right. Along towards afternoon we found smoke in the same place. We went down and found that the fire was underneath. If there had been a sprinkler at that point, without any question it would have stopped the fire. At that time the question was raised whether it would not be a good plan to put perforated pipes or put some sprinklers there so that we could turn the water on in that place and sprinkle the surface over, a question I thought seriously of a year ago. It is a place we could not injure. The dust goes down under the floor, which is perfectly fire-proof, and if you built a bonfire there it would not hurt anything. But it occurred to me at that time whether it would not be wise to have a sprinkler there, not sealed, so that we could turn the water on and sprinkle that place over. So that fire does sometimes go through the dust flue.

Mr. EDWARD ATKINSON. My suggestion on this question would be, wherever you have a place where you are dead sure that you never can have a fire, put a sprinkler right there. [Laughter.]

Mr. ROBERT MCARTHUR. Speaking of putting sprinklers in the dust flue, I cannot imagine how that would prevent a fire. If we have a fire in the picker and it passes through to the dust chamber, this sprinkler will not let off instantly. The fire will get past it before the sprinkler starts, and you have your fire in

the dust room. I supposed that most dust rooms are equipped with sprinklers; ours are.

Mr. LOUIS SIMPSON. Hear, hear!

Mr. ROBERT MCARTHUR. But the idea of putting a sprinkler in a dust flue seems to me to be very absurd.

Mr. LOUIS SIMPSON. Mr. President, I would like to reply to Mr. ATKINSON, that if you were to carry out his principle you would have to sprinkle the whole universe.

The PRESIDENT. Mr. ATKINSON represents the underwriters, you understand.

Mr. EDWARD ATKINSON. My friend says that to carry out my idea you would have to sprinkle the universe. I will say in reply that I have been advised to take a sprinkler with me into the next world when I pass on. [Great laughter.]

Mr. LOUIS SIMPSON. Nobody but our friend himself dare to have said that of him.

Mr. EDWARD ATKINSON. Seriously, gentlemen, according to our experience, the sprinklers in the trunks leading to the pickers may not operate. Here is a friend that can tell you that they do not always go off because the heat passes by and the cool draft upon them prevents their action, then the fire may get into your dust chamber and perhaps into your dust flue. There are some dust flues where there are no cyclone dust collectors which open out, distributing lint and combustible substance about the neighborhood; where that is the case there had better be a sprinkler even in the dust flue, else burning lint may go outside and may do damage outside. The case is very remote but it may happen; in some of the worst cases, where a good deal of stock was carried out, the cyclone dust collector has been put in, and it pays for itself in saving the lint and only lets stuff pass that can hardly burn. I stick to my text, as I

used to about buckets—when you have buckets enough put in some pails, and when you have pails enough put in some buckets; and so about sprinklers. We find that fires occur where nobody expects them. Be sure to put a sprinkler there.

The PRESIDENT. The next subject on our list is "Gray Goods from the Bleacher's and Finisher's Point of View," by DANIEL MOORE BATES, Jr., of Wilmington, Del.

GRAY GOODS FROM THE BLEACHER'S AND FINISHER'S POINT OF VIEW.

DANIEL MOORE BATES, JR., Wilmington, Del.

A paper dealing with the gray goods from the standpoint of a finisher of them will, in an association of cotton manufacturers, of necessity trespass upon dangerous ground. The bewildered owner of goods which for some reason do not turn out well, when assured by the mill that the trouble is with the finisher, and by the finisher, that the trouble is with the mill, often complains bitterly that he is "between the devil and the deep sea." It is the object of the present article to review some of the difficulties which are encountered in giving the proper finish to gray cloth, and if in any way a closer understanding of each other's needs is brought about to the end of "submerging the devil" and clearing up "the mysteries of the deep sea," its aim will be accomplished. That a more intimate knowledge of the other's needs and limitations is possible for both manufacturer and finisher there is no room for doubt, but to effect it the questions of common interest must be approached in a spirit of cordial co-operation rather than viewed in the light of mutual hostility. The topics herein suggested are taken up as matters deserving further inquiry and investigation rather than as subjects passed upon and fully settled. This paper will review the following, in the order named:—

Selvedges.
Strength tests—their importance.
Warp sizing.
Mill measurements.

Make-up of the gray goods.

Minor matters, of importance to the finisher.

Strength testing—details of the Rockford method. (Appendix.)

SELVEDGES.

No part of the construction of a piece of gray cloth demands more attention than the selvedge. Upon it the finisher must depend to get his goods through the processes of singeing and of bleaching; it is, as it were, the railroad track on which is run the body of the cloth. The requisites of a good selvedge are strength combined with elasticity, and a weave which will render the edges of the piece presentable and attractive when it comes up to the folding room. Mere strength, at first thought, would seem all that is required, but this when unaccompanied by pliability is useless. For good results it is necessary to have the selvedges strong and even enough to avoid all likelihood in running through the bleach-house of a break or fray, which, be it ever so slight, will cause a tear clear across the piece. At the same time they must be sufficiently elastic to allow the body of the cloth to take its full share of the strain, as otherwise the chances of the selvedges failing under the severe pull put upon them are largely increased. It is this latter reason which explains why selvedges may be made *too strong*.

Tape selvedges, so common for example on three and five-leaf twills and fine plain goods used for umbrella purposes, on satines and on fine cambrics, are pre-eminently strong selvedges looked at from the "gray goods" point of view. Few selvedges, however, give more trouble in work than these, as at present made. I have recently made a careful examination of the general construction of selvedges on a number of umbrella cloths like the above. There were nine lots of them in work at about the same time, all of which gave a great deal of trouble from the selvedges breaking in the bleach. The general construction of the selvedge was as follows:

2 lots—3 leaf twill.	Warp 3-ply, twisted.	Filling woven in double.
1 lot —" " "	Warp 2-ply, ⅓ (inside) untwisted, balance twisted.	Filling woven in single,
3 lots—5 " "	Warp 2-ply, ⅓ (inside) untwisted, balance twisted.	Filling woven in single,
1 lot —" " "	Warp 2-ply, twisted.	Filling woven in single.
1 lot —" " "	Warp 3-ply, twisted.	Filling woven in double.
1 lot—plain weave.	Warp 2 and 3-ply (alternating), untwisted.	Filling woven in double,

It will be seen from the above that the selvedges of each lot have one or both of these characteristics, namely, a two-ply weave of the filling, and two or three-ply twisted warp threads. Both of these conditions I consider disadvantageous—the weaving in of the filling *double* because by this there is less take up of the warp threads of the selvedge, than if the filling were woven-in singly, and hence less stretch in them when the selvedge is under tension; the *twisting* of the two or three-ply warp threads because they are thus made less elastic than if woven in two or three-ply *untwisted*. It must be confessed that later my belief that the whole of the difficulty was due to these constructions of selvedge was somewhat shaken by finding that the greater number of thirty-two lots of three and five-leaf twills, run since, having selvedges similar to the above, came through without showing any trouble in this respect. Of these, 21 lots had selvedges with double woven filling, one with alternating single and double filling, and 10 with single woven filling; while all but one had all or most of the selvedge warp threads two or three-ply *twisted*. However this may be, it is a fact that a selvedge which is too tight and which causes the cloth to wrinkle up along its edge gives as much trouble in finishing, as a loose and flabby selvedge gives in weaving.

Doubtless much of the difficulty which finishers have with selvedges is laid by the manufacturer to improper singeing. Singeing is a necessary evil—or rather, it is necessary for most finishes, and an evil only when the selvedges are not right. When the cloth strikes the singe-plates a very strong pull on

tight selvedges is needed to flatten down the body of the goods and give it proper singeing. Indeed, it is often impossible to effect this where the cloth bellies badly, and despite everything that can be done the goods leave the plates with a rough, unevenly singed surface, which no amount of pains and care later in the finishing processes can overcome. Moreover, a heavy pull draws the selvedges so hard over the hot plates that there is great danger of burning them. This sometimes happens, the amount of singeing depending not only on the redness of the plate and the speed of the cloth, but on the pressure of cloth on plate as well. Thus the strongest selvedges in the gray often prove the weakest when put to a practical test. The natural and simple preventive for the trouble just mentioned is to wet the selvedges when the goods are laid out in piles ready for singeing. Here, however, a new difficulty is encountered, many tape selvedges when wet curling up to such an extent as to render them like cords by the time they reach the plates, and thus necessitate an even harder pull to smooth down the cloth as it passes over.

When the cloth reaches the bleach-house the weakened selvedges show up. Breaks in the goods as they are drawn through the pot-eyes down into the rinsing, chemic and souring machines, and ensuing wind-ups round the rolls, are not infrequent. Many yards are wound up before the machine can be stopped, and the cloth which has to be cut off to free the rollers is lost for all practical purposes. Not only is the loss of yardage from this cause a source of annoyance, but the short piece lengths thus made between stitchings are hard for the trade to dispose of.

To sum up this matter then, the difficulties which selvedges cause are due principally to their being too tight. Whether this may be corrected by a change in their construction, by running all selvedge threads through the slasher from spools having less tension than the warp beams, or by some other means, cannot be discussed here. Tape selvedges seem for the finisher's work too much a thing apart from the body of the

cloth to run well with it; at least our experience with them is that they do not work as satisfactorily as the unpretentious ones found on many plain weave goods, a selvedge for example of two-ply untwisted warp and single woven filling. It must not be inferred that, because the selvedges of umbrella cloths are specially mentioned above, these are the only ones which give trouble. At the time of writing recent difficulties on these goods were fresh in mind and they were naturally taken up as affording good examples. From time to time, however, the tape selvedges on satines and cambrics have proved equally perplexing problems.

I cannot leave the subject of selvedges without again emphasizing the intimate bearing they have on the success of the finisher's work. If the selvedges are not such that the cloth can be properly singed, all the efforts of the manufacturer to turn out goods with a smooth, evenly woven surface, and all the investments of the finisher in costly machinery of the best and latest types for producing lustre and brightness — calenders, presses, beetles and the like — are thrown away as far as the finish is concerned. Fine goods must be singed to finish them, and with poor singeing the work of the finisher can subsequently never be made right.

STRENGTH TESTS—THEIR IMPORTANCE.

Of all matters which demand intelligent consideration by both manufacturer and converter, as well as finisher, the question of strength is the one most neglected. When the converter wishes to handle goods for a certain finish he specifies very carefully the count, width and weight which his goods must be made, but of the strength needed for the use to which the finished cloth is to be put he generally tells the manufacturer nothing. The manufacturer accordingly produces goods of the required width, weight and count to fill the order. Being pursued by the relentless competition of the present day, he naturally puts no more twist in the yarns for these goods than is necessary to make them weave in a satisfactory and economical manner. The

width, weight and count of the gray cloth being according to contract, the goods are accepted by the converter, who sends them to the bleachery to be finished. Suppose, as is often the case, that the finish is an old and standard one which has given satisfaction to the converter for a number of years, but that, on the other hand, the mill from which this lot comes is one which has never before sent goods for this finish. It is quite possible that these goods will come up tender and unfit for the use intended, especially if the finish is one requiring a moire effect, or something of that nature, where the finishing work is severe and puts a heavy strain on the cloth. If such is the case, the owner of the lot expresses great surprise that the finisher, after years of experience, should tender his goods on a standard finish. To the claim that the cloth is from a new mill and not the same as that formerly sent, the invariable reply is that the width, weight and count are no different from previous lots. Well enough—but granting this, is the strength the same? Probably not, for this is just the very point which both converter and manufacturer have overlooked—the strength demanded for the required finish—and yet this is the essence of the whole matter, the strength in cloth of the same grade from different mills often varying considerably. In plain weaves it is of course desirable to have evenly woven cloth of the right weight and count, but it is no less important that goods to be used for purposes such as dress linings must have enough strength first, to undergo the processes required for the finishes the trade demands, and second, to give satisfactory wear in the uses to which they are put.

Again, very often cloth woven for stock is bought up by a converter as "spots" and sent off to the bleachery to be finished. Here of course the manufacturer has nothing to do with the future use of the goods, his only aim being to turn out a readily marketable product. It would, however, seem natural for the converter to satisfy himself before buying as to whether the strength of the goods is sufficient for the use intended. I question whether in nine cases out of ten this point is considered at

all. If the "spots" are the desired width, weight and count, that settles the matter, and if things do not go right afterwards "it is the finisher's fault."

It is therefore in self-defence, if for no other reason, that the finisher must have an accurate method of testing the strength of cloth. Then when the charge of tendering goods is brought to him it is a simple matter, by testing the strength of gray and of finished samples, to learn the exact truth. If the fault is his, it is to his advantage to know it at once; if another's, he has here satisfactory proof of the fact. For obvious reasons it is important that the manufacturer, too, should accurately test the strength of his gray goods before they go out. If a standard method of testing the strength of cotton cloth could be arranged between manufacturers and bleachers generally, a great advance would be made, especially since it is recognized by those who have studied the matter that tests of the strength of cotton cloth give comparative, not absolute results, which differ according to the method used.

For those interested in this matter, I give at the end of the paper the details of the method of cloth testing employed at Rockford. This method is scientific, practical, and, we believe, more accurate than any other in use.

WARP SIZING.

This is a point which particularly interests the bleacher. The successful sizing of the warps is by no means proved, simply because the cloth leaves the loom sufficiently free from knots to show few warp threads broken in weaving. In the first place the size should be as simple as possible in composition and the warp should contain the smallest amount of it needed. Gray goods are found to lose roughly, something like 14 per cent. in weight by bleaching; of course part of the loss is accounted for by the waxes and resins found in raw cotton, but a considerable amount is made up by the size in the gray goods.

MR. GEORGE W. BEAN in an article on "Methods of Sizing

Yarns," Vol. 56, of the Transactions, gives a number of different figures for the percentage starch in gray goods, varying according to the formula used. His percentages run from 1.66 to 4.00, averaging nearly 3 per cent., while the size formula which he recommends is stated to fill the cloth with 3.6 per cent. While never having gone deeply into the matter, I should say from my general experience that four per cent. is a minimum figure for the amount of starch which bleachers have to remove. When it is considered that in a kier of 6000 pounds of cloth even one per cent. of unnecessary size would necessitate the removal of 60 pounds of superfluous matter and would hamper the bleaching process by just that much, the need of careful judgment in this matter is self-evident, not to speak of the saving thereby to the manufacturer. Moreover it is of vital importance that every ingredient of a sizing mixture shall be known and thoroughly understood by those who use it.

Not long ago a lot of lawns which were being run into work gave way on the warp in a most remarkable manner as soon as the goods struck the singe-plates. Indeed, many pieces on reaching the vats in the bleachery were in ribbons. Careful examination of the singed cloth showed no indication that the goods were in the least burned. Comparison with a gray piece from the same lot showed that while the strength of the filling was about the same in the gray and in the singed piece, the warp which was apparently all right in the gray had become quite rotten after singeing. A chemical analysis of the ash of the gray cloth showed the presence of considerable magnesium chloride, and also of a distinct trace of potassium, of aluminum, and of a sulphate—probably common alum. These salts had presumably entered the cloth as ingredients of the size in some form or other. Whether the salts were put in as such, or were contained in some sizing compound, there was no way of determining.

In Mr. BEAN'S paper, above referred to, the chemicals which appear as such in the formulas given are acetic acid, blue vitriol (copper sulphate), and alum. According to the article on

"Chemical Analysis of Sizing Compounds" by Mr. HENRY T. WHITIN, Vol. 57 of the Transactions — an article undertaken in continuance of the work of Mr. BEAN — none of the special sizing compounds examined were found to contain metallic salts, with the exception of one, having zinc oxide for weighting purposes. There were, however, in some, small amounts of free acid. On a trip through some of the New England mills two years ago, I remember being told of a sizing mixture in use at one of the mills which, among other things, contained chloride of calcium and *a little vitriol.* Putting vitriol into the size for warps seems so incredible that I may have misunderstood. Anyway I jotted this down in my note book and there it is yet. It was the only instance met with where salts were used, so far as I was informed — but New England manufacturers are reluctant to tell everything they know about their size.

In order to determine with some degree of accuracy the effect of singeing cotton cloth containing metallic salts the following experiment was tried. A piece of evenly woven 28 inch, 64x64 cloth, unsinged, was boiled out in one of our kiers with caustic soda, soured off with a weak vitriol solution and thoroughly washed up. The piece, which was then free from size and all foreign matters, was next immersed at different parts of its length in one per cent., two per cent. and three per cent. water solutions of common alum, and one per cent., two per cent. and three per cent. solutions of chloride of calcium respectively. Each part immersed was wrung out by hand from the hot liquor, and the whole piece was dried out over the steam cylinders. The piece was then singed on one side over two plates, and the different parts tested for strength on the cloth testing machine with the following results.

Samples were tested wet at 9-16 inches speed — see details of Strength Testing. The figures in each case represent the the average of three breakings. The warp strengths only are considered here, as, owing to the more even spinning of warp yarns, these give the fairest comparative results.

		Warp, Pounds.
(1)	Sample bleached, not singed, no chemicals,	325
(2)	" " singed, " "	317
(3)	" " " steeped in 1% alum solution,	41
(4)	" " " " " 2% " "	29
(5)	" " " " " 3% " "	19
(6)	" " " " " 1% calcium chloride solution,	193
(7)	" " " " " 2% calcium chloride solution,	117
(8)	" " " " " 3% calcium chloride solution,	97

The above figures speak for themselves. It should be noted that tests (1) and (2) show the effects of singeing unadulterated goods under the most unfavorable conditions, because all the size which ordinarily is present and protects the cloth, has in this case been removed. Yet even under these circumstances the warp shows a loss by singeing of less than 2 1-2 per cent.

To find whether alum if present in very small quantities would still injure the cloth when singed, and also to eliminate any effect of the steam cylinders, another experiment was tried. Two four yard swatches from the same bleached piece were steeped in hot alum solutions of 0.1 per cent. and 0.4 per cent. strength respectively. They were then squeezed out on a mangle and air-died. After singeing over two plates as before, the pieces when tested wet showed the following strengths:

		Warp, Pounds.
(9)	Sample bleached, singed, steeped in 0.1% alum solution,	291
(10)	" " " " " 0.4% " "	279

The above removes all question as to whether salts of acids, and particularly alum, should have a place in sizing compounds and mixtures. From Mr. BEAN'S paper, in which one formula calls for 2 1-2 pounds of alum to 200 gallons of water—or 0.15 per cent., and another for four ounces of alum to 90 gallons of water—or 0.03 1-3 per cent., it is seen that five years ago current methods were not free from this most harmful practice.

MILL MEASUREMENTS.

The question of mill measurements is one which, as between manufacturer and finisher, often proves vexatious. As the goods are ordinarily handled they are measured over folding machines soon after coming off the loom. Undoubtedly after the cloth leaves the loom there is a certain amount of contraction varying in each case with the nature of the weave and the tension on the warp. Whether it would be possible to let the cloth stand a longer time after weaving before measuring it would probably depend somewhat on the condition of the market and the movement of cotton goods. It is also a question whether the full contraction of the cloth can take place while it is closely rolled up in the form in which it is woven. If not, it would be necessary to fold it off loosely and allow it to stand awhile bundled up before it was accurately measured. This would mean an additional operation and an extra expense. It is hardly probable that such a method could be adopted; at the same time it seems a practical thing to make from time to time tests as outlined above on all standard grades. In this way a fair percentage allowance for contraction could be figured for each line of goods, and this used in determining the net gray yardage. Possibly such a method may be employed in some mills. That some arrangement of this kind is just, and that it would save much wear and tear between the mill, the owner of the goods and the finisher, seems evident. The question is brought forward here more with a view of inviting general consideration than of suggesting the proper solution. It has been noticed of late by most finishers that many goods such as bedford cords, warp satines and high count goods generally, when finished, show on the average a decreased percentage gain in length over the gray yardage, as compared with that of former years. Is this, perhaps, due to the warps being woven under greater tension than formerly?

MAKE-UP OF THE GRAY GOODS.

In getting the gray cloth ready for baling it is most important to see that there are no hand-sewings in the middle of the pieces. All such places should be evenly sewed on a machine before the cloth leaves the mill. There is no inexpensive, practical method by which hand-sewings can be detected at the bleachery in time to avoid the break-downs which they cause at the singe-plates or in the bleach. It is out of the question to attempt to examine carefully in the gray the thousands of yards daily run into work. Moreover, irregular piece-lengths should be avoided wherever possible, as often when cloth is finished for special purposes these cause loss to the consumers who have their machines arranged to cut a definite length into smaller pieces of a given yardage with the minimum amount of waste.

It is a common practice in folding the gray goods at the mill to crumple up the inside end of the piece with the hand as the cut is doubled over ready for baling. This, and the subsequent compressing in the bale of the mussed-up end, cause creases often extending a yard or more into each piece. As some pieces are only 50 yards in length, this may mean a creasing of from two to four per cent. of the cloth. These creases cannot be gotten out of the goods when they are run into work, no matter how carefully the piece-ends are sewed together. They cause much trouble in singeing, resulting in an uneven surface on the finished cloth, especially on grades like satines which come up to the folding room with fuzzy streaks, making remnants of many yards which with the least bit of care at the mill would come out perfect.

Another small detail which is of importance is to have the markings on the gray piece-ends made with a chalk crayon, free from wax or grease, which will bleach out, instead of with black lead or graphite, which cannot be removed. This is a matter of increasing importance as our mills go on higher and finer grades of cloth, the constant tendency now in New England. Formerly, careless habits like those mentioned were overlooked

and allowed to continue. Then the loss of a couple of yards on goods worth about two cents a yard seemed trivial, but now as the mills go on goods worth six, eight and ten or more cents to the yard these small details assume a new meaning.

MINOR MATTERS OF IMPORTANCE TO THE FINISHER.

There are many little details of manufacturing which, though seemingly of small moment, make a vast difference in the excellence of the finish. In marking bobbins on the spinning frames, just as in marking piece-ends of the gray goods, care should be taken to have no crayons used which contain wax or anything not readily removed by bleaching. Such marks when not removed, as well as oily threads, are decidedly objectionable in high grade, white dress goods, and lower their market value. Reverse twist in the yarn, caused by careless band-boys in the spinning-room, is also a source of trouble, particularly with goods like lawns, having an elastic finish, as it makes them curl up when finished in a way that renders them difficult to handle. The spooling together of different yarns, making variations in the warp of the cloth, is another point which deserves attention.

In weaving, the defects which cling to the goods to the very end are temple-marks, which show up on light shade satines, on linings and beetled work; misdrafts, on twills, welts, etc.; reed-marks, which ruin the finish of the finest satines; and the mixing of mule and ring filling, of American and Egyptian cotton, and of different numbers of filling yarns, which, together with oil stains, are harmful to all grades. "Mill oil" is especially injurious to high grade cloths. On looms weaving these a lubricant should be used as free as possible from all mineral oil, as the latter will not bleach out.

Uneven weaving appears principally in the low count, cheap grade goods. Many of these are used for clay filled bag work and for cheap linings for other than clothing purposes. It is often impossible to fill such goods on account of the unevenness of the weave. Naturally we cannot expect to have these cheap

goods perfect. At the same time smoothly working let-off and take-up motions on some looms would work wonders, and would curtail rather than add to the expense of manufacture. As explained above, it is impracticable to have the gray goods carefully examined at the bleachery. It is, therefore, often the case that a lot of goods is bleached and ready for sizing before the trouble with the weave is discovered. At that time it is too late to get any satisfaction out of the manufacturer, who piously washes his hands of the whole matter, being convinced that the pull on the cloth in bleach is responsible for the bad condition of things. In such a dilemma the only resource is to watch carefully for the next lot of similar goods from the same mill, and on its arrival make a thorough examination. In many instances defects in the gray cloth are found, and repeated experiences of this kind convince us that finishers are not the only ones who have their failings.

Many faults will necessarily appear in cloth from time to time; the less there are, the better for all concerned. So far there seems from our point of view to be a lack of that hearty co-operation on the part of the manufacturer which is needed to remedy existing evils. Too often when complaints — such for example as the appearance of American and Egyptian staples in the same piece — are brought forward, the manufacturer declares that such a thing is impossible in his work and dismisses the matter from his mind without giving it the least investigation. Probably from his point of view there are failings, also, on the other side, times when he believes the finisher does not know what he is talking about, or when the finisher jumps to hasty or uncalled-for conclusions. Looking to the future, each should take the keenest interest in the other's advancement. The New England cotton manufacturer is constantly doing finer and better work. He realizes that to meet foreign competition it is necessary not only that the cloth shall have the same width, weight and count, but that in these high grades there must be an evenness of spinning, a smoothness of weaving, and a certain delicate touch which American cloths have not heretofore pos-

sessed. In this advance the finisher is taking his part. He is procuring the most modern machinery, using the latest processes, keeping in touch with all that is new both at home and abroad. If under these circumstances manufacturers and finishers of cotton cloth join forces and work heartily together, there can be no resisting them.

APPENDIX.

Strength testing — details of the Rockford method. To obtain accurate and reliable results in testing the strength of cloth, the following points must be taken into consideration.

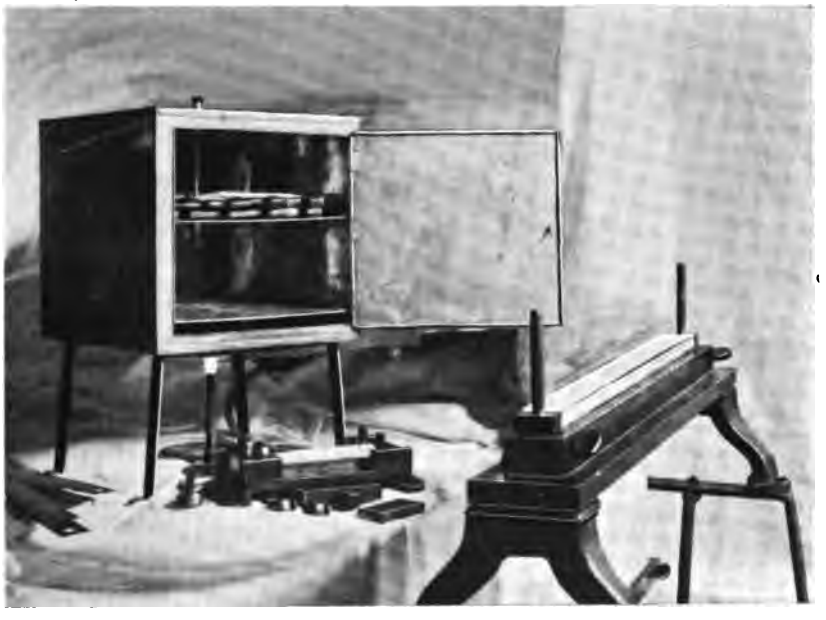
1. The samples of cloth to be tested must always be in the same condition as regards moisture.

2. The speed of putting the load on the specimen must be uniform.

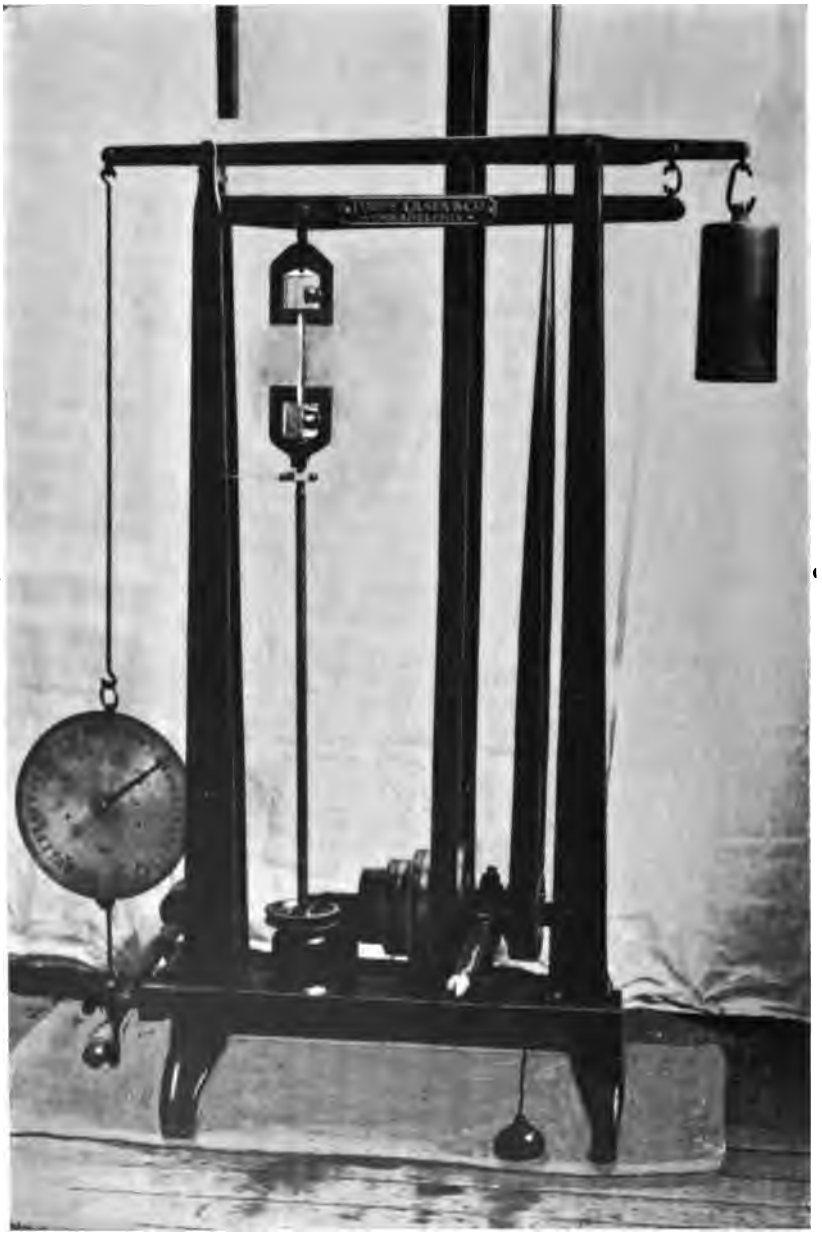
3. The breaking load must be borne equally by all the threads (warp or filling) of the sample tested — *i. e.* there must be no tearing.

4. The samples must be evenly made and equal in length between the jaws of the testing machine.

It is a well known fact among all who manufacture or handle cloth that the amount of moisture which it contains varies continually with the condition of the atmosphere. Perhaps it is not so generally understood that the strength of the cloth varies directly with the amount of moisture it contains. Mr. GILMORE of the class of '92, Massachusetts Institute of Technology, on investigating this matter, found that the difference in strength of the same piece of cloth, when first tested dry and then tested saturated with water, was as great as 40 per cent. of the dry strength. He also found that intermediate conditions of dampness gave results between those above mentioned. It is, therefore, essential, in order to obtain accurate comparative results, to have the condition of the cloth always the same, and as absolute dryness or complete saturation are the only definite standards within reach, dryness has been selected in our work as being the most practical method. If, however, there is any reason to believe



OVEN, GAUGE AND FOLDING STAND.



CLOTH TESTING MACHINE.

that the cloth contains chemicals which by concentration will injure it when heated, the samples should be tested wet. The samples before testing are placed on shelves in a little oven and dried out for at least an hour at a temperature of about 185 degrees Fahrenheit. They are then taken one by one from the oven and tested in the machine immediately, no time being allowed for them to absorb any appreciable amount of moisture from the air.

Mr. GILMORE, also, in his experiments, found a variation in the strength of the same piece of goods according as the speed of the machine varied, and he concluded that the least variable results were obtained at a constant speed of the lower jaw of not less than 0.6 inches or more than 1.0 inches per minute. In our work the standard for speed is 9-16 inches (0.56+ inches) per minute.

To insure having the breaking load uniformly distributed among all the threads under tension, it is essential first, to have a smooth, well-made sample; second, to so fasten in the jaws of the machine the ends of the sample that the line of tension shall pass directly through the middle of it throughout its entire length; and third, to so arrange the holding of the jaws in the machine that they shall take up any uneven stretching of one edge or part of the sample over another. If attention is not given to these details, the load will be thrown first on the tightest threads which will fail first, then on those next, and so on, the result being a tearing of the specimen instead of a test of its tensile strength.

If the samples tested are not of equal lengths between the jaws there is opportunity for unequal amounts of stretch before rupture of the several specimens. This inequality of stretch is likely to affect the tensile strength and render the results less accurate.

The apparatus used at Rockford (see cut on opposite page) consists of an iron stand for folding the cloth samples, having two pins 24 inches apart and a set of steel templates 1 1-2 inches wide and 1-32 inches thick with holes at each end; an iron

gauge for accurately setting the specimen in the jars of the machine (which are detachable) so that the centre-line of stress shall coincide with the centre-line of the sample tested; and the testing machine itself. The last is built on the compound lever principle with a self-registering Chatillon spring balance: its frame is about 4 1-2 feet high and two feet wide. The chief features are the driving by power — through a worm and wheel which operates at a uniform speed the screw-shaft holding the lower jaw, the cone-pulleys which admit of four different speeds for one speed of driving shaft, and the arrangment at each jaw of double knife edges, at right angles to each other, to prevent any cramping or tension of the specimen. The little pointer on the screw-shaft, immediately under the lower yoke, is for measuring the stretch if desired.

The samples as tested are five-ply, each fold being 1½ inches wide. They are made this width because it is difficult to have templates as thin as those used, accurately planed any narrower. An odd number of folds is taken to get one raw edge on each side of the sample, five folds being selected as giving a better average strength per thread than three, and still not making the sample thick enough to slip in the jaws of the machine. The actual number of threads broken has been found to equal very nearly 5 x 1.5 x number of threads per inch.

Our gauge is made for samples five inches long between the jaws. Any convenient length will do provided it is adhered to as a standard. As the cloth is folded over the stand it is nearly 24 inches wide, and one such length furnishes three test specimens, each 7½ inches over all which allows for 1¼ inches in the jaw at each end.

The following tests were made to prove or disprove the results of Mr. GILMORE regarding the efiects of moisture and of different speeds of testing. A glance over them shows that in general his conclusions are upheld. The figures represent in each case the average of three breakings. Where the samples were tested wet, they were first made up dry, and after being cut to 7½-inch lengths were immersed in boiling water until

thoroughly saturated. Before the samples were withdrawn the water was cooled down so that they should not leave the bath in a steaming condition. They were then tested dripping wet. The samples are from three pieces of cloth, *A*, *B* and *C*, from the same bale of 28-inch 64x64 goods.

		A		B		C		
	Speed per Minute.	Warp, Pounds.	Filling, Pounds.	Warp, Pounds.	Filling, Pounds.	Warp, Pounds.	Filling, Pounds.	Tested.
1	9	201	135	206	133	201	137	Dry
2	9	295	238	299	251	287	222	Wet
3	9			211	117			Dry 20″ sample
4	13.5	219	162	217	147	211	137	Dry
5	19	222	141	203	149	217	135	Dry
6	41	221	164	221	134	216	147	Dry

The gain in strength by saturating with water is, from (1) and (2),

for A,	46.8 per cent. on warp,	76.3 per cent. on filling.
" B,	45.1 " " "	88.7 " " "
" C,	42.8 " " "	62.0 " " "

Also, the least variable averages for both warp and filling are those from tests (1) at a speed of nine, the samples being dry—our regular method of testing. Lastly, from (1) and (3) it is seen that a difference in the length of the samples has an effect on the breaking strength, even when all other conditions are the same.

Mr. RUSSELL W. EATON. Mr. President, I would like to ask Mr. BATES whether the experience of the bleacheries is that they have more trouble than formerly or less trouble in regard to oil stains in their goods; whether the general experience of bleacheries is that there are more or less than a few years ago.

Mr. DANIEL MOORE BATES, Jr. Mr. President, my experience does not extend over a great many years, but my experience is that we have less. When the trouble comes it usually comes in a bunch, so to speak; that is, there is one lot of goods which perhaps shows the oil stains very badly. But I think in general there has been a great deal less trouble and that it is decreasing.

Mr. LOUIS SIMPSON. I think on that question I can give some light to our friend. You are now making finer goods than ever before, goods that used to be finished entirely in England and France, and these goods are made in the special places where they give attention to these small matters. I know a firm engaged in this line, personal friends of mine, and I know the difficulty they have had, because I am similarly situated — I have been "in the soup" myself in the last twelve months in getting my weavers to make these goods as they ought to be made. The trouble is that you are not making them as good as these fine goods are being made in England and elsewhere. If you want to get your trade and to hold it, you will have to make your weavers do as well as elsewhere.

Mr. DANIEL MOORE BATES, Jr. Our manufacturing department is very limited. A good deal of our work is in the nature of manufacturing cloth for window shade purposes. Wherever it is possible, where there is no reason to prevent, we use an oil which is almost entirely free from mineral matter, and we find no trouble whatever in getting these stains out if there are any stains in the cloth. Of course, in goods for shade cloth purposes every little spot and defect show up against the light, so these goods require, perhaps, more care in this respect than any other goods.

Mr. RUSSELL W. EATON. If I may be allowed, I would like to ask Mr. BATES another question; that is in regard to covering of bales of cloth sent to the bleacheries. I would like to inquire whether he finds a different practice among mills, some mills covering them quite thoroughly and others covering them very little?

Mr. DANIEL MOORE BATES, Jr. Mr. President, in answer to the inquiry, we find for the most part that they simply cover bales on each end. This, I must say, in many cases does not thoroughly protect the cloth. Some kinds of goods come entirely covered, but the majority, I should say, are just covered on each end.

Mr. RUSSELL W. EATON. Also, whether the goods that are only partly covered are in his opinion properly covered, and if not, whether there is any claim that he has known of made against the mills for not properly covering the goods, or whether there are any favors shown to the mills that do properly cover them by sending back to those mills the coverings so that they can use them again? What is the custom of bleacheries in his section; is it the custom to send back to the mills this burlap?

Mr. DANIEL MOORE BATES, Jr. My impression is that the burlap is not usually returned. I have no doubt that so far as finishing is concerned an arrangement could be made whereby it could all be returned. Very often, when cases of this kind come up, it has been found that the cost of returning such coverings, which, as I say, are usually scanty, has been about equal to the value of the coverings themselves.

Mr. RUSSELL W. EATON. Mr. President, I bring this up because Mr. BATES has been very kind to point out defects of the manufacturer. Now, in my experience it has happened that goods are thoroughly covered so that it is practically impossible for them to receive stains; requests sent to the bleachers to kindly return those coverings, and no attention paid to the

request whatever—not in the case of all bleacheries, but of some. It is a very hard case for mills that try to put their goods up in good shape, try to cover them and put them on the market in good shape, to have no attention paid by bleacheries to that point; not from your own concern [to Mr. DANIEL MOORE BATES, Jr.], but from similar concerns.

Mr. DANIEL MOORE BATES, Jr. Mr. President, there is no doubt that very frequently the transportation companies are guilty of gross neglect. Very often goods come which have been spotted with acid, which, from the very nature of the holes eaten in the cloth, has not gotten on the bales before they left the mills, but which undoubtedly came from the use of cars which have recently contained carboys of acid. Our method is, wherever it helps to furnish evidence of carelessness in the handling by the transportation companies, to keep coverings or anything of that sort, so that afterwards the matter can be brought forward and the claim, if any, adjusted. Of course, as a general thing, the coverings have no individuality except the marks, which very often come off, and we keep no track of them. If there is any special reason we retain them, and have them ready for the proper time of bringing forward the claim.

Mr. STEPHEN A. KNIGHT. I think it is very rarely the case that finishers of goods return the burlaps. I have had quite an experience in that direction, and as a rule burlaps returned are unfit for use the second time. They get very much soiled in transportation. After they have once been marked, if you turn the marks inside, if they get wet or dampened they mark the cloth, so it is just about as well not to have any covering on it at all. We have sent a great many goods away for finishing such as Mr. BATES speaks about, for shades and for various purposes, where they are very particular to keep the goods nice. We have had an arrangement with the finisher whereby we would cover the bottom of the car with common cotton bagging, and the finisher has kept that and allowed us the

price we would get for it if we sold it as waste. That is the only experience I have had where we have ever obtained anything out of the covering, and when we do that we just barely put burlap on the two sides, the top and bottom, running up perhaps six or eight inches on the two edges; we put nothing on the ends whatever, but have an abundance of bagging in the bottom of the car, charging the finisher just the actual weight of it, and he selling it for the same. This protects the cloth from the dirt and I really think is a better practice than attempting to use the burlap a second time. I have no doubt but that if manufacturers made a request to that effect, as a rule they could get that allowance, because it is no cost to the finisher and it is certainly a great help to him in the condition in which he gets his goods. We have found quite a number of finishers who have been willing to do that.

Mr. DANIEL MOORE BATES, Jr. In speaking of the matter of returning burlaps, I referred more to our own experience in connection with the requests of customers, that they be allowed to return to us cases or burlaps used on goods which we sent them in a finished condition. All of our goods which go away in the form of rolls are completely covered with burlap, and when we looked into this matter I remember we found that the freight charges more than ate up the saving which might otherwise have been made.

Mr. STEPHEN A. KNIGHT. I think that is correct. The only remedy for that would be for the finisher to make an allowance for those burlaps equal to the price that he could sell them for, which would be much better than returning them.

Mr. WILLIAM P. DEMPSEY. The question whether the manufacturer should cover the whole bale with burlaps or only the ends, remains for him to decide. If he wants to take the chance, which I think is very small, of injury, and only cover the ends of the bales, that is for him to decide. If he prefers to cover it all over, he can put in the extra burlap. In my experience

there are very few goods damaged on account of having burlap on only top and bottom. Unless it is going quite a distance I think that burlap all around the bale is quite unnecessary.

Mr. DANIEL MOORE BATES, Jr. Mr. President, I agree with the gentleman who has just spoken, for this reason: that in transportation the causes of injury for the most part are two; one, by dampness or acid stains, which would probably take effect through the burlap if the whole bale was covered, and the other, from tearing by improper use of hooks; and both of those traceable directly to the transportation people, and neither of those would be in any way obviated by the use of burlaps around the sides as well as the ends of the bale.

Mr. ROBERT R. SMITH. Mr. President, I would like to put a question to Mr. Bates, although it seems as if we had catechised him pretty well already. There is no manufacturer present, I presume, who manufactures goods for the bleacher but is more or less, and has been for years, troubled with oil stains—oil stains, oil stains, over and over again—and most of us have tried in every way that we could possibly invent to avoid it. We have used "stainless oil," and we have used the various kinds of oil that have been furnished to us by the dealers, trying to avoid this oil stain. I would like to inquire of Mr. BATES if he has discovered any difference where the parties have used an animal oil—say a good sperm oil, what we call a stainless oil—and a quality of oil consisting of paraffine with perhaps a little animal oil mixed. Either one of the oils will gather more or less of black stain in the looms and the bagging that will fly among the goods. Now, if there is any difference between the use of pure animal oil and mineral oil in the amount of stain that we have, I should like very much to know it.

Mr. DANIEL MOORE BATES, Jr. I do not know whether I understand the question correctly, but there is no difference whatever in the spotting of the goods; that is simply a question of the care used to avoid putting surplus and unnecessary oil on

the bearings of the loom. But the stains which do appear are much more readily bleached out if they are composed entirely of animal oil than if they are composed of mineral oil. It is simply in the bleaching out that the question of animal and mineral oil comes in. The rest of it depends upon the amount of care and administration in the weaving room. I think that answers the question.

Mr. ROBERT R. SMITH. That answers my question.

Mr. LOUIS SIMPSON. I think I can answer that question more fully, because some years ago I made the question of oil a matter of considerable study. I found that a mixture of one-third animal or fish oil with two-thirds mineral oil will bleach out. But if the oil has been used and has become impregnated with particles of iron and brass, it does not made any difference what the oil is, the stain will not bleach out. On the other hand, if you have the stain of a pure hydro-carbon mineral oil, it will not bleach out. When I find a stain from the pure oil without any metallic substance in it I have it soaked in olive oil, when the olive oil combines with the hydro-carbon, and when it goes into the kiers it boils out without much trouble.

Mr. DANIEL MOORE BATES, Jr. Speaking of pieces of iron and that sort of thing reminds me of one point not brought out in the paper, and that is the large amount of damage caused by pins and needles being placed in the goods when they are on the looms by operatives who do it unthinkingly and very carelessly. Such things cause us any amount of trouble; they get into the rolls of our cylinders and finishing machines; they may cut thousands of yards—we try to have them cut only a few hundred; they will do that, any way. Of course we cannot have every roll examined every minute; it would cut off production. At the same time, if the greatest care is not exercised in this respect, a great amount of damage is done, and I do not think too great care can be used in the mill to prevent these

things. Very often you can find the original place where the pin was placed by the rust mark which is still there.

Mr. STEPHEN A. KNIGHT. All bleachers have more or less tronble in that direction. We bleach a great many goods ourselves; we do not color any goods; but we have a great deal of trouble with pins and picking out comb teeth and anything of that description. We have made a great many yards of cut cloth at every revolution of the roll.

Mr. DANIEL MOORE BATES, Jr. The only reason I brought the matter up was this, that once we sent a needle with a small swatch showing the rusty place where it had been in the cloth back to one of the mills. The next mail brought a large package which contained a needle perhaps six inches long, accompanied by a note saying, "We don't use any small needles in sewing our goods. This is the kind we use." I realized at that time that the needles do not come from the mill management.

Mr. JOHN GREGSON. Mr. President, several years ago I had some cloth sent to a print works in which a pin or needle had been inserted. I presume it was done accidentally by the weaver. A claim was made by the print works, and I remember the cost of the damage was pretty excessive—something over $100. I placed in the weave room a printed notice that whenever any pin, needle, piece of wire, leather, wood or any foreign substance was found in the cloth by the inspector in cloth room, I would make a charge of one dollar against the weaver and pay that one dollar to the inspector in the cloth room. By that means the mill made no money of the transaction but it received cloth in first-rate condition.

I had not charged the one dollar more than two or three times before the trouble of having pins and such like articles woven in the cloth was stopped. I then went a step further. If a pin or needle or other foreign matter should be found in the cloth by the operative on the folding machine, then I charged one dollar to the cloth room girl who had passed the cloth through her

machine without finding it, and gave the one dollar to the operative on the folder. This system worked very well and brought the trouble down to a minimum.

The PRESIDENT. May I ask if that was carried out in Massachusetts?

Mr. JOHN GREGSON. In Massachusetts, yes sir. [Laughter.]

Mr. ROBERT B. TREAT. Mr. President, I will say that in our experience in manufacturing shade goods, covering a period of some 25 or 30 years, in that particular line of goods, we have had the same difficulty regarding the oil question which has been mentioned, and we have never succeeded in finding an oil that would bleach after it had passed through the machine and the stain had come from the machine. Also that the custom of fines or charges with regard to pins or comb teeth being found in the cloth we adopted some ten or twelve years ago, and while the number of comb teeth and pins has not been entirely eliminated and the trouble has not been entirely cured, yet we find that we are troubled very much less from that cause than formerly; but whereas we formerly charged a dollar fine, the weavers made such a row about it and such talk and complaint, that we had to reduce the fine to fifty cents, which we find brings about practically the same result. I simply mention this as adding additional testimony to the remarks that have already been made on these two questions.

Mr. ROBERT R. SMITH. Mr. President, a number of years ago we were manufacturing cloth about 30 inches wide, weighing all the way from six to eight ounces a yard, and sending it to the bleachery in the bale, 60 or 70 yards in the piece, with iron hoops in the usual form. It occurred to us that it would save in handling on our part and save handling at the bleachery if we should send those goods in a large roll, 1,000, 1,200 or even 1,500 yards. Consequently we arranged our machinery so that as the cloth came through the calender it was rolled into

these large rolls, 1,000 yards each, then a burlap was simply put around, a string tied around the edge, and the cloth was sent to the bleachery. There had not been but a few rolls shipped before complaint came back that they would rather we would put the goods into the original form of bale. Not being able to understand why that should be so, I went down to the bleachery and found that by sending our goods in the long roll, it did away with one hand who tended the machine, and that man was out of a position, and his complaint had come back through the superintendent, and they asked us to discontinue for that reason. But after the matter was fully explained the cloth has been sent forward in large rolls, and it seemed to me that so far as the quality of the cloth goes—creases and things of that kind which I heard Mr. BATES speak of this afternoon—those troubles have been entirely done away with.

Mr. DANIEL MOORE BATES, Jr. There occur to me two reasons why from our point of view it is not as convenient to handle the goods in rolls as in bales. One is that if there is any question about the measurement it is much easier to check it from the pieces as they are marked in the bale, and the other is that when the goods come on rolls they have to be folded off in piles before we can lay our goods out to be run into the work. If the goods come in bales the pieces are there, all piled up, and each piece is just thrown over and the end thrown out and sewn together, and it requires much less handling—that is, as we put the goods through—than if they come in rolls. If they come in the rolls they have to be folded off first and the whole process gone through with, and that takes time.

Mr. STEPHEN N. BOURNE. Wouldn't you prefer to have them come in rolls if you could have them 300 or 400 yards in a piece? You get rid of your seams then.

Mr. DANIEL MOORE BATES, Jr. There is just this about it, that in a car lot, as we run it, there may be from 35,000 to 50,000 yards, and in our bleaching system we have two wagons,

and of course each wagon will contain from 17,000 to 25,000 yards. That is all run down into the vats first and then into the wagons in one continuous length, so that if we were to get a roll large enough to fill a wagon it would be all right; otherwise it is not so convenient.

Mr. LOUIS SIMPSON. Mr. President, I think that our friend is not quite right there. I also use Mather and Platt kiers and I am just preparing now to adopt the principle of running my cloth off rolls, but I can understand what his trouble would be. It would be this, that he could not rely on the piecings made at the mill. Unless the piecings are properly made there might be no end of trouble all through the bleachery. If the manufacturer would guarantee that he would make his piecings properly, it would save all trouble in the bleachery. We make our own piecings at the mill and see that they are properly made. To get cloth in rolls would be a great saving to every one and would obviate a great deal of complaint in regard to the finished goods, because it would do away with all these creases and bad ends which are a constant trouble to every one.

Mr. DANIEL MOORE BATES, Jr. In that way I could see quite an advantage in the rolls by doing away with the creases; that undoubtedly is a great nuisance.

The PRESIDENT. The next paper is on "The Drying of Cloth," by ALFRED A. HUNTING, of Salem, Mass.

[Read by the Secretary in the absence of the author.]

THE DRYING OF CLOTH.

ALFRED A. HUNTING, Salem, Mass.

To dry cloth quickly, first squeeze it as dry as possible. Squeeze rolls should be of large diameter and perferably a two nip machine; the greater the diameter of the rolls the more contact the rolls will have, therefore the cloth is under pressure a longer time, and can be squeezed drier with less pressure than it will take to squeeze to the same degree of dryness when rolls of small diameter are used. Cloth that is starched or filled will be much better prepared when large rolls are used, the starch or filling will be forced to the center of the cloth giving a more even finish. Large rolls properly made are ridged and will not spring perceptably, when rolls spring even squeezing cannot be done, the center of the cloth will be carrying more moisture than the edges, the wettest part of the cloth governs the speed of drying. Every pound of water squeezed from the cloth provides for quicker drying, it also saves steam, which means a saving of money. Cloth will carry much more than its own weight of water and still seem to be pretty well squeezed, but compare such cloth with that which has been properly squeezed, the difference will be marked. Cloth can be squeezed at fast speed so that 100 pounds of cloth will be carrying only 75 pounds of water.

Conditions have much to do with the squeezing of cloth but there is no reason why cloth cannot be squeezed better than is generally being done. The drying of cloth is expensive under the best conditions, the following comparisons will serve to give you an idea of the cost. The memoranda was obtained for the

purpose of determining as closely as possible the number of pounds of cloth that one pound of steam would dry, when the drying cans were running under the ordinary conditions. The memoranda was obtained at different factories and under the varying conditions as found, the time ranging from four or five hours to an aggregate of several days; in each case the water discharged from the cans for a given time was weighed, the yards, weight and kind of cloth was recorded, and the average taken. The average of several lots of cloth weighing from 12 to 9 yards per pound condensed in the drying cans 2.50 pounds of steam per pound of cloth dried. This amount of steam was very high, but the cloth carried 125 pounds of water per 100 pounds of cloth, and the vapor from the water evaporated from the cloth was not promptly removed from the drying room.

A lot of cloth weighing from nine to six yards per pound condensed two pounds steam per pound of cloth dried.

A lot of cloth weighing from 3.75 to four yards per pound condensed 1.77 pounds of steam per pound of cloth dried.

A lot of the same cloth squeezed drier condensed 1.60 pounds of steam per pound of cloth dried.

A lot of seven-yard cloth was dried at the rate of 1.30 pounds of cloth per pound of steam.

A mixed lot of cloth containing runs of heavy and light cloth was dried at the rate of 1.30 pounds of cloth per pound of steam. The cloth of the fourth set of figures was better squeezed than was the case of the first two, the last two lots were better squeezed than the previous four lots, and the vapor in the drying room removed to a greater extent than was the case of the first two lots, but not as satisfactory as it should have been to have obtained the best results. The weight of the cloth did not seem to have as much effect in condensing the steam as did the amount of water the cloth was carrying and the fact that the vapor in the drying rooms was not promptly removed. The averages severally show as follows:

1.	One pound of cloth	condensed	2.50	pounds of steam.			
2.	"	"	"	"	2.00	"	"
3.	"	"	"	"	1.77	"	"
4.	"	"	"	"	1.60	"	"
5.	"	"	"	"	.77	"	"
6.	"	"	"	"	.77	"	"

By analyzing the above it shows that the first lot of cloth required three and one-fourth times more steam to dry one pound of cloth than was required by the last two lots.

The fourth lot was the same kind of cloth as the third but was better squeezed, the saving in steam being 22 per cent. Cloths that are sized, mordanted or dyed all have different condensing effects, the amount varying as much as ten per cent. Cloth being damp when it goes on to the cans lengthens as it dries, and soon the cloth does not wrap the cans tightly, this allows air to come between the surface of the cans and the cloth. When this happens the cloth cannot dry as fast as when the cloth wraps the cans closely and a good contact is made by the cloth and cans; to obviate this the take-off roll or the fly frame is arranged to pull the cloth to keep it tight on the cans. This is bad as it makes the cloth narrower than it otherwise should be by pulling the loose cloth; it would be much better to have the speed of the cans increase gradually from the entering to the delivery end of the machine; this can be easily accomplished by having one less tooth in the gear to every third can, or any proportion suited to the work that would do away with the loss of contact between cloth and cans, and consequent loss of drying capacity, also stop the necessity of any pull by take-off roll or fly frame. The surface of cans should be kept clean and polished, and also free from dents, every square inch taken from the surface contact of a can means a loss in drying effect. And here let me say when you buy cans or have the heads repaired, see that you have heads that can be removed by the unscrewing of a few bolts, this will allow of inspection and it will allow you to make such repairs as may be required. Cans should be inspected inside as well as out often and regu-

larly. The internal construction of the frames, cylinders and the connecting parts of a set of drying cans is another factor in the economy of drying. Frames with small inlets and small passages through the standards and journals to the cans are expensive machines to dry with, they require a higher pressure of steam and more steam per pound of cloth dried than is required by a machine that has large passages through frames and connections. As cans are now constructed the so-called buckets or scoops are defective, they do not at all times remove the condensed water promptly, this causes water to accumulate in the cans. Water is not a good conductor of heat, the presence of water in the cans acts as a condenser to the incoming steam, the water absorbs and carries away much heat that should be passed through the metal of the cans and used in drying cloth. Water also holds air in the form of bubbles, after a time the presence of air will show itself by the cans not drying as fast as they should; remove the water promptly, the accompanying evils will take care of themselves. The steam pipes that supply drying cans should be fed from over head, then the connecting piping can be properly drained of water that is carried by the steam, and practically dry steam only allowed to enter the cans. As the frames are generally constructed there should be one supply pipe entering the frame for each three cans, and in some cases even more, and each so proportioned that the steam will flow at a low velocity, this will allow steam to be used at a low pressure which is always desirable.

To find the effect of water carried by steam as a retarder of drying, the piping of a set of cans was so arranged that the water that was in the pipes carried by the steam between the boilers and the cans could be taken out and not allowed to enter the cans. First the steam was allowed to enter the cans in the usual way carrying everything in the pipes, the amount of water discharged from the cans for several hours weighed, during the time a record was kept of the kind of cloth, yards and pounds that was dried. Then the water carried by the steam was discharged to a separate receptacle from that holding the water

discharged from the cans for a period as long as the first, also a record of cloth, etc., was kept, the same as in the first case. The amount of water taken from the piping was an amount equal to 30 per cent. of the total amount of the water in the first case when the pipes discharge everything through the cans. The amount of drying was almost 30 per cent. more when the water carried by the steam was kept from entering the cans. By letting the water from the pipes again enter the cans as was the case in the orignal, the amount of water discharged from the cans was the same as at first, as was the amount of cloth dried. The prompt removal of all vapor from drying rooms is a great help to quick drying, as it stops the condensation on and the consequent dropping of water from the ceilings and walls. The dripping of water is very unpleasant in itself, it causes everything to be damp, makes floors wet and nasty, damages the cloth and causes the timber of the whole drying room to decay. Cans should be cased up in a well made tight room, the space around the machine being large enough to allow of going around it to do any work necessary. Do not allow any air to enter other than from a properly arranged supply.

All air that goes to drying cans should be of a temperature from 130 degrees Fahrenheit to 200 degrees Fahrenheit, the air allowed to absorb all of the vapor that it will quickly and then be removed. Air taken from any place that may be convenient is a very expensive feature in drying. In many cases the air that is allowed to go to a set of drying cans condenses as much steam as does the cloth itself. Air freed from moisture, heated and moving briskly is a very fast drier, it expands in volume with the temperature, and it is hungry for moisture.

The following table gives the quantity of water which air is capable of absorbing to the point of maximum saturation in grains per cubic foot for various temperatures. In one pound avoirdupois there are 7,000 grains.

By refering to the table it will be readily seen why air taken from any source and not heated is expensive.

Table showing grains of water which can be held in suspension by a cubic foot of air at various temperatures.

Degrees Fahrenheit.	Grains in a Cubic Foot.	Degrees Fahrenheit.	Grains in a Cubic Foot.
0	0.93	80	310.7
10	1.10	85	12.43
15	1.31	90	14.38
20	1.56	95	16.60
25	1.85	100	19.12
30	2.19	105	22.00
32	2.35	110	25.25
35	2.59	115	30.00
40	3.06	130	42.50
45	3.61	140	58.00
50	4.24	157	85.00
55	4.97	170	112.50
60	5.82	179	138.00
65	6.81	188	166.00
70	7.94	195	194.00
75	9.24	212	265.00

The metal of which the drying surfaces of cans are made is another factor that must not be overlooked. Drying cans for fast drying should be made of copper, the first cost is more but the economy of their working soon offsets that. What the metal has to do with drying will be shown by the following tables, tinned iron and copper only being shown.

First,—The specific heat, the specific heat of solids and gases being the quantity of heat in British thermal units, required to raise the temperature of the body one degree fahrenheit.

Water at 32 degrees Fahrenheit = 1.000
Wrought iron = 0.1146
Copper = 0.0965

Say 16 per cent. in favor of copper.

The heat radiated from cans is lost, the drying being done by contact. Metal that will radiate the least heat being the best.

Tinned iron = 15
Copper = 11

Say 26 per cent. in favor of copper.

The relative heat conducting of the two metals is: copper 80, iron 42.

Here the iron has only 52 per cent. of the value of copper and conductively is the largest factor in drying by contact, *i. e.* by drying cans.

To sum up, the factors that govern drying of cloth by drying cans are, — good squeezing, proper arrangement of drying rooms, the heating of air admitted to drying rooms, prompt removal of all vapor from the drying room, large passages for steam in frames, cans and connecting parts, proper number of supply pipes and of sufficient area to the frames for the amount of drying required, all pipes to cans to be carefully drained of water, proper discharge pipes from frames, good heat conducting metal for drying surfaces of cans, careful inspection and repairs and the cans to be kept clean and bright.

The PRESIDENT. We will pass to the next article, "Points on Sizing, Finishing and Packing Goods," by ARTHUR PARKINSON, of New York.

The SECRETARY. Mr. President, I had a letter from Mr. PARKINSON informing us that he has been called South on business, and I will read the paper in his absence.

POINTS ON SIZING, FINISHING, AND PACKING GOODS.

ARTHUR PARKINSON, 13 Gold St., New York.

In dealing with this subject, a descriptive style has been adopted. Due allowance is made for unavoidable limitation of space, and it is hoped that the few important questions discussed will be of interest.

Sizing of cotton yarn is one of the principal factors in manufacturing. Its importance lies in the fact that poor or weak yarn can be improved considerably, and that good or strong yarn can be damaged so much, that it is unfit to weave. Aside from the fact that the sizing or slasher machine must be in fit condition to turn off good work, and that the attendant must be qualified by varied experiences to execute his work intelligently, the important question is, what materials shall we use to give good weaving qualities and have no trouble with the after processes of bleaching, dyeing, and printing. It is of great importance that manufacturers should consider the fact that there are many articles suitable for use in sizing of yarns, but which cause much trouble in bleaching and dyeing.

One point I wish to advance in this connection is the use of starch and tallow alone for sizing warps. It has been proved a failure many times, for the reason that the fats which they used were not saponified. In such cases after sizing, when the warp is cool, the fats remain on the surface of the yarn and if the weave shop is kept damp, the fat rubs off a little in the reed, and causes stains in the bleaching of the goods. Many of these stains do not show in the bleach; but they are plainly visible in the dyeing or printing.

The risk in using tallow is much greater than formerly, because nearly all bleacheries have abandoned the method of steeping the goods in water, before the liming process. There are many different systems of sizing which are well known. I refer to the formulas contained in textile publications, but it is useless to discuss which of them are the best. To follow up such methods would require a high salaried man in each mill, who would thoroughly understand how to compound them, and it would be costly in other ways. There are many compounds on the market, prepared by several manufacturers of sizings, all of which are claimed to be "the best". The great competition in this line of industry has resulted in cutting of prices and a lower standard of quality by several makers of sizings; all of which have come under my observation. The component parts of these compounds are generally unknown; but it is satisfaction to know that one or two reliable concerns are not ashamed to tell customers what they are buying. Some preparations contain from 15 to 20 per cent. solid matter, and some contain earthy materials, also sulphate of lead, sulphate of calcium, sulphate of zinc, and other dangerous materials. It is wise to steer clear of such stuff, for it is like paying for water and is very liable to cause trouble in the bleaching, etc.

Good sizing compounds are neutral, colorless, and transparent. They should be perfectly soluble in water, and should contain at least 40 per cent. solid matter. The proper size to use on prints, or the finer qualities of goods, is that which does not interfere with the bleaching, etc. Pure sizing for weaving qualities, is all that is desired for converted goods. The sizing compound must strengthen the starch both in volume and adhesive power, which will also penetrate and give the yarn tensile strength, and contain sufficient softening material to offset the hardness and brittleness of the starch, thereby giving a smooth feel, which also prevents the cutting of the harness eyes.

Some concerns on cheap export goods do not vary their methods of sizing; that is, they practically size the same as for domestic goods. This is peculiar. Making cheap gray goods for

export means that such goods call for medium or heavy sizing. If this is maintained same as in Europe, where such goods are chiefly made, there would be a better export demand, which would keep prices high with domestic lines.

Yarn for heavy sizing must be soft spun, and the size must be made of strong binding and filling ingredients, which will also give a soft full "feel". A good heavy sizing for medium or coarse yarns is made with starch or flour, and Arabol gloy. The latter material combines readily with starch and flour, or with china clay, and acts as an assistant to penetrate and hold the size on the yarn, also gives a soft feel to the goods and prevents fungi growth or mildew.

The sizing of colored or bleached yarns also requires a neutral gloy sizing. Potato starch sizing is excellent for warps for napped fabrics, as it stiffens the yarn nicely, which is necessary to get an even, full napp. Arabol starch gives similar results.

It seems unnecessary for me to discuss the many processes of finishing cotton goods for I find that American finishings of cottons are not inferior to the European finishes, but rather better in many respects. Much progress has been made of late years in fine and fancy finishing. New gums for finishing have been invented in America; the principal one is Arabol giant gum, a pure white powder, which contains great stiffening properties and gives a clear or transparent finish. It does not give weight for it is used almost as clear as water, and the finish is superb. It is far in advance of European finishes on organdies, laces, curtains, and embroideries, which has enhanced the reputation of American organdies and fancy goods. The importance of marking goods and packing them properly for export is very important. If a consignment is made to China or any other country, mark each piece and put them up in the most attractive way, which is acceptable to the people in that country. When packing goods for this trade instructions as to requirements should be carefully followed, for it is frequently desired that packages should be so made or formed as to be easily

handled, at the place of destination, according to the means of transit to the interior parts of these foreign lands.

English houses generally charge for the small extra outlay in packing goods for export. Cotton goods are put in waterproof bales only. This is cheaper, better, and easier to handle than using packing cases. I submit the following particulars of a packing system, which a Manchester house followed for years. The materials are placed in the following order, when baling cloth in large quantities for export:

	Light circular band of Steel
(Outside)	Linen Canvas (24 Pick goods)
	Brown Paper
	Patent Tar Cloth
	Double Gray Paper
	Linen Oilcloth
	White Paper
The	Cotton Goods (middle)
	White Paper
	Linen Oilcloth
	Double Gray Paper
	Patent Tar Cloth
	Brown Paper
(Outside)	Linen Canvas
	Light circular band of Steel

The PRESIDENT. The last article on our list today is topical question

110. Is it economical to place compound condensing engines in a mill to supplement water wheels during the periods of low water, where the times of such service are short, and fuel expensive?

Capt. JAMES G. HILL. To answer the question proposed by that topical number I found it much more difficult than at first glance appeared, because so many unknown quantities enter into the problem, such as the duration of a drought, its magnitude, its recurrence, etc. Profits and steady employment and many other factors may enter, and some do, into the problem. But to consider at length all, would spin this paper or discussion beyond the limited time. Hence, if we confine ourselves to the cost of producing this supplemental power, we may find an answer. To take a broad view of the question I tried to consider all classes of mills and sections.

In 1896 there were about 825 cotton mills in the country, with 18,753,935 spindles, requiring about 475,000 horse power, or an average of 22,732 spindles and 575 horse power per mill. Of this number but 176 mills had 30,000 spindles and upwards and 239 mills had 20,000 spindles and upwards, leaving nearly 600 mills under 20,000 spindles. At first it appeared that this large number of small mills might be shut out of topical question No. 110, but upon further investigation I found most, if not all, could be included.

Today small as well as large mills can install the best of steam plants adapted to their particular wants at a moderate cost. Large plants of 1,000 horse power will cost about $50 per horse power, while small plants of 100 horse power or less will cost nearer $100 per horse power to install, but the cost of installation is nothing as compared with the expense of running a steam plant.

To ascertain if it is wise to install compound condensing engines in mills to supplement the water power during a drought of short periods, with expensive fuel, can be determined only by

assuming some definite period for low water and some positive price for fuel. Suppose we assume six days of drought, during which time the loss by low water is half the power required, and the price for fuel $4 per gross ton. With these figures we can make a calculation and find the cost of steam power. First take a large plant. Suppose a mill of 2,000 horse power, and by the terms of the supposition one-half the power or 1,000 horse power must be supplied by steam. A modern compound condensing engine ought to furnish this power for ⅔c. per horse power per hour, if run economically. The profits of a mill of this size would be, say, 5 per cent., which would give a profit of $20 per hour or $500 more than the cost per week. Second, take a smaller plant, say 500 horse power, then by the terms of the supposition we must supply 250 horse power for a week. The best engine for this purpose might produce a horse power for one cent per hour and if so, the expense would be $150 for steam. The profit of a mill of this size would be, say, 5 per cent. or $4.81 per hour or $288 per week. In both cases please observe the profits are larger than the expense, but the difference is small and with the uneconomical conditions imposed by topical question No. 110 would I fear soon disappear.

However, there are still other factors that affect the question. One is, if you stop a portion of your mill you lose that product in the market. Another factor, and a very important one, is that of keeping employes steadily employed. In conclusion I should say, on the whole, the mill would find it economical to put in a steam plant and therefore answer topical question No. 110 in the affirmative.

The PRESIDENT. Are there any further remarks on this subject? If not, this meeting will stand adjourned until ten o'clock tomorrow morning.

The meeting then adjourned until Thursday morning, April 27, at ten o'clock.

THIRD SESSION.

THURSDAY MORNING, APRIL 27, 1899.

The Association met in Chipman Hall at 10 A. M., President KNIGHT in the chair.

The PRESIDENT. The gentlemen will please come to order and be seated. Our first paper this morning is from Mr. PHILIP DANA of Westbrook, Maine, "What Belting is Made of, and its Care."

WHAT BELTING IS MADE OF, AND ITS CARE.

PHILIP DANA, Westbrook Me.

The saying that you can't make a better razor than there is stuff in it, would apply equally as well to belting as to razors.

The standard leather belting today is undoubtedly the oak tanned leather belting so universally used in cotton and woolen mills. Nothing seems able to take its place.

Cotton woven, wire woven, rubber and numerous other kinds of belts have been tried and have failed to last, to transmit as much power or give as general satisfaction as the leather belt, except in cases of extreme moisture or steam as in a dye house, where rubber belts have succeeded the leather ones.

Steer hides from Texas and the western states are largely used for the best belts. The center of the hide from the shoulder nearly to the tail, the lower part of the sides and the belly being cut off, is used for the best belts, as this is of fine grain and solid, stretching but very little.

The very center of the hide about twenty inches in width, and from four and a half feet to five and a half feet in length, according to the size of the butt, is used for the larger belts. The strip on each side of this a few inches wide is used for the smaller belts.

Ordinary belting weighing from fifteen to sixteen ounces to the square foot will vary in different tannage in tensile strength from four hundred and fifty to one thousand pounds to the inch. The hide from the neck, the lower part of the sides and the belly being coarse and spongy, stretches badly and is not used in the best grades.

It takes six months to properly tan leather. It is then stuffed or curried with tallow to make it firm and pliable. This keeps it from cracking and adds considerable to the weight. After being curried, which is quite a complicated process, it is stretched until nearly all the stretch is taken out.

The strips of belting should be put together by short laps six to eight inches long. A longer lap makes the belt stiff and is more apt to include a poorer part of the hide.

In putting laps together I prefer the use of cement only. We find that rivets wear off, catch and come out, spoiling the surface of the belt and letting it drop to pieces long before it is really worn out. It is the same with double belts, which are stitched on both sides; the stitches wear out long before the belt does, letting the belt drop to pieces. The stitches also spoil the smooth surface of the belt.

Some six years ago in putting in a large belt we were very much put out to find it full of worm holes. We complained of this and were told that the holes did not injure the hide. Sometime after we learned that wormy hides could be bought two or three cents per pound cheaper than perfect ones.

As regards the life of a belt little can be said with accuracy, so much depends on the conditions in which it is used. A large driving belt on large pulleys and not overloaded should, if properly cared for, last from twenty to thirty years. We have two belts which have run more than twenty-five years. An agent of a large mlll says that he has belts doing good work after running for thirty years. Cone belts do not last more than two or three years, and some a much less time. A belt constantly running from a tight to a loose pulley of course gets racked a good deal and cannot last more than ten to fifteen years. In our picker room the belts were cared for by two men. The one kept his belts clean and used but little belt dressing; the other when a belt slipped instead of cleaning it or taking it up, laid on a lot of belt dressing. The first one's belts are almost as good today as when new, while the other one's are badly rotted and almost unfit for use. In a room full of dirt,

like a card room, belts should be carefully carded and then dressed very lightly once a week.

Whenever possible, belts should be made endless, thus ensuring smooth running and a longer life; the place where the belt clamps or lace leather is put in always breaking first.

Recently a white mineral tanned leather belt is being introduced. The claims for this belt are that it stretches very little and is not injured by oil or water. Yarn or cloth that has no stretch or elasticity seems to be lacking in strength also, and I should think that the same would apply equally as well to belting. This belt does not seem to be injured by oil. Defective cement has prevented our giving it any time test.

In England, a belt is being quite extensively introduced made from the hair of the Indian buffalo which is woven and and then painted on both sides. The claims for this are that it has more elasticity and resistance to wear and water than leather belting.

Another belting very pliable indeed and recommended for use on small pulleys, and in places where the belt runs with a twist in it, is the so called Indian tanned leather belt.

In figuring for main drives, if possible, the slack should be on top instead of underneath the pulley. This allows more belt to rest on the pulley, resulting in less slipping. This gives more power and enables one to use a slacker belt.

The best belt is the cheapest if properly cared for and not overloaded.

TOPICAL QUESTION.

111. What is the superiority of iron beams over those of Southern pine for mill floors?

The SECRETARY. Mr. President, I have here in writing from Mr. F. P. SHELDON, of Providence, R. I., the following:

Mr. FRANK P. SHELDON. My experience with steel floor beams has given me the opinion that they are decidedly superior to timber, if supplemented with a proper construction of the flooring. One very important advantage is, that the walls are not weakened by any wall pocket and air space, as is the case with a large timber, the steel beams being built into the brick work solidly. In the ordinary construction, with timber, this is a weak point in the walls, making them the weakest at the very point where the most stiffness is wanted.

The above points have been practically *decided* to my satisfaction, in the No. 3 Berkshire Mill, and also to that company's satisfaction, and there would be no hesitation on their part in repeating it in another mill. The floors and walls are much stiffer than in mills with timber beams, and the machinery runs much better on this account. I do not consider that the use of steel beams make a mill any more hazardous as a fire risk.

The PRESIDENT. Has any one any remarks to make in regard to this matter, any questions to ask or any suggestions to offer?

Mr. WOODBURY K. DANA. I would like to ask the comparative cost of steel beams and wooden ones.

Mr. LOUIS SIMPSON. I do not think anybody would be prepared to answer that question because prices are jumping all the time. I would like to ask, Mr. President, if insurance companies will allow us to use steel beams, because if I had understood last year that they would, I would have used them in preference to wood, even if they had been more expensive, because I have

found great difficulty in getting a stick of timber large enough in section to be strong enough for wide bays. I have also found difficulty in dry rot. The thicker the section of the timber you use on your beam, the more trouble you have with the dry rot. But I have always understood that the mutual insurance companies were dead against the use of steel beams.

The PRESIDENT. Is there any one who can give any light on this matter in regard to the underwriters' value upon mill beams, whether of steel or wood? Personally, I could not give any positive information. Like Mr. SIMPSON, I have understood that the insurance companies as a rule prefer wooden beams.

Mr. FRED C. MCDUFFIE. Does not Mr. SHELDON say in his paper that steel beams were used in No. 3 mill of the Berkshire Company, or something to that effect?

The PRESIDENT. They are used there.

Mr. FRED C. MCDUFFIE. They were used there, I believe he states.

The PRESIDENT. Yes, sir.

Mr. FRED C. MCDUFFIE. That has a slight bearing, perhaps, on whether the insurance companies will allow it or not.

The PRESIDENT. They are used to some extent for that purpose. I do not understand that insurance companies prohibit their use, but of the two they prefer the wooden beam. Mr. ATKINSON is not here, and I do not know who there is representing the insurance people who could give us any light.

Mr. LOUIS SIMPSON. I am surprised to hear that the Berkshire Company were allowed to use steel beams, because I have been refused, but I know that they have been used there. I have found, however, that certain gentlemen can get things allowed them that are not allowed other people, and I thought perhaps the insurance people allowed the Berkshire people to

use them as an experiment, and therefore I was anxious to learn the result, because when iron is cheap I would very much sooner use the iron than the wood.

The PRESIDENT. I do not know whether there is any one in the house who can give us any information on that subject in regard to Mr. PLUNKETT'S experience. Could you say anything on that, Mr. LOWE? Do you know enough about it?

Mr. ARTHUR H. LOWE. I have no information with reference to it.

Mr. EDWARD ATKINSON. I only wanted to say that I hoped the time has not come and will not come when unprotected steel beams will be incorporated in a timber structure. The destruction of so-called fire-proof mills in England and in Russia and other countries has been very marked. The sudden heats generated by very rapid ignition of cotton and other fibres expand the metal and twist and tend to destroy the building by heat rather than by fire, and therefore the steel unprotected is about as dangerous a member as you can introduce. How completely a building of that sort may be destroyed you have had an illustration of in the Washburn & Moen case, where the gas generated from oil fuel that had remained in a pit sixteen hours after there had been no fire there, found its way into what we thought was a substantially fire-proof building, and igniting, tore it all to pieces and made a total loss.

If steel is incorporated, there are many methods of safeguard. But there is still a great contest. The terra cottas mostly fail. The expanded metal and the plastering on wire lath serve a very useful purpose. There are other means of safe-guarding, but they are mostly expensive, but there is one to which your attention has not yet been very much given, which will not be expensive and which is worthy of being thought about in other places than on steel beams, and that is the hard asbestos board.

Asbestos, of course, in a solid condition is well known to be

a quick conductor of heat and no safeguard at all. But asbestos holding entrapped air which cannot circulate is one of the most effective things that can be used, and this hard asbestos board with entrapped air all through it, made from a quarter of an inch to an inch in thickness, has a most extraordinary power of resisting heat, even from a blowpipe. I have made one or two references to it in my reports, and am about to make another in a new edition of our mill plans which we are now making for missionary purposes. I would also name as another fire retardent which has lately been greatly improved, the substance called salamander, to lay between floors. It is now so well made that you may count it a cheap and effective fire retardent, and also water-proof. If we had only secured something like salamander between the top floor and the plank floor of mule rooms, we would have saved a great deal of money in water damage. The mule fires are now the most dangerous fires, and the leakage through the floors upon stock which may be below makes an enormous difference.

You may have noticed that in one recent case we have had a loss of nearly $40,000 from a mule fire and only $4,000 in another, because there were in the latter case no cards underneath. These two substances, salamander and asbestos board, should receive your attention for protecting wooden surfaces. I think the salamander will probably be more effectual over boilers or in similar conditions than tin, because tin is apt to sag, and if there is any humidity it gets behind and the tin rots out I think the salamander will prove to be the best and wherever you have metal surfaces exposed, as you may in beams if hard pine gets too expensive, you will need to think of these cheap and probably effectual safeguards which are apparently better than terra cotta and better than any of the other substances yet devised, so far as we yet know.

I speak of our mill plans; you are all familiar with the fact that we keep our general plan printed constantly. We are now being called upon by architects all over the country for these plans to guide them in preparing their risks. Heretofore

we have had a great deal of difficulty in undoing the poor work of architects who had not considered the danger of fire. The architects are now falling in. If any of you have any suggestions to make by which these various plates may be improved, they will be most welcome, and if any of you will volunteer to aid me in making them more perfect, it all comes back to your interest, because you will be mutually insured with the new risks. I will send the present edition of the plates and ask your criticism and your aid to any one who desires them.

Mr. LOUIS SIMPSON. Allow me to ask, Mr. ATKINSON, whether the last Berkshire Mills. in which they have used these steel girders in place of wood, have these girders protected? I have not been through the mill.

Mr. EDWARD ATKINSON. They have not. The contract for that mill was made before we knew that it was proposed to use steel, else I should have written to Mr. PLUNKETT to suggest that it would perhaps not be judicious. We insured the mill, but we should have preferred to have the girders protected. Of course the danger is remote. If a fire gets by the sprinklers and requires the apparatus in chief to properly hold it it may be held under a steel beem as you hold it under a wooden beam.

I do not think it will be a cause of rejection of risk and perhaps not even a cause of difference in rate where the mill is otherwise thoroughly protected. But as between the wood and the steel there is in my judgment today a greater hazard from the unprotected metal than from the heavy wooden beams. That is as far as I go.

Mr. LOUIS SIMPSON. My point is this, that last year, when I got the plans for our new mill, I was told distinctly by the mutual insurance companies with which we insure in Providence — Mr. ATKINSON will not go into Canada, it is not good enough for him — that they would not accept steel beams, and in order to get the strength I wanted I had to go to the expense of buying big pine sticks and putting them between fish plates, three

inches thick, which are thoroughly protected by the wood on each side and bolted through the two beams. This, of course, has caused the construction of our mill to be more expensive that it would have been had we been allowed to do as they have done at the Berkshire. They do not give me any less rate for having done such good work. It seems to me either the insurance companies ought to make a rule and stick to it, or else they ought to make a difference in the rate. I think probably that the beams as we have put them in at Valleyfield are safer than steel; I think Mr. ATKINSON is quite right on that point. But still it would seem to be not quite fair that we should be at the extra expense and get no return.

I would like also to ask Mr. ATKINSON if he has ever made any experiments with a plaster which is now made in Canada called asbestic. If not I should be glad to send him samples of it. I was thinking of using it to protect our picker house ceiling. I am very anxious indeed to get all the best improvements, Mr. ATKINSON, and if you will allow me to trouble you I shall be very glad to send you anything of the sort.

Mr. EDWARD ATKINSON. In regard to what the underwriters may do or may not do, it will be observed that we do not undertake to control or direct the construction or operation of any mill or works of any kind. That is not our function. Each man decides for himself what is best for him to do, and then, if what is best for him has not proved consistent with the mutual relation of one mill with another, we decline to insure him. But we do not attempt to control material, construction or anything else. We give you the best information we have. When it comes to the question of rate, there is more or less discussion of rates all the time and it is more or less a waste of the time of the owner and the underwriter. Somebody has got to decide what is about the fair mutual relation of one mill to another. Of necessity that falls to the underwriters, whose experience covering years and a wide extension of mills, may be assumed to be of some value, and they come as near to it as their judgment per-

mits. If that is not satisfactory to any existing member or any prospective member, we have no power to force him to take our policies, and we would a little rather he would not. We would rather every member would be satisfied that he is justly treated.

When I took hold of this business 21 years ago there was a variation in the proportion of premium lost on the eleven different classes into which I divided the risks, running from a loss of 12 per cent. of the premium paid in up to 69 per cent.; we have brought that down to a variation of less than seven points on either side. Therefore, I think we have succeeded pretty fairly in adjusting rates. If we have not nobody is asked to take the policies. I should be delighted to go into Canada so far as the risks are concerned—you have some excellent risks in Canada—but the Boston company has so large an amount at risk and so much to do that my directors have not thought it desirable to extend.

In regard to the asbestic, I had my attention called to that by Mr. BOAZ some time ago. It seemed to me one of the most promising of the fire-retardent plasters that had ever been brought to my attention. I asked Mr. BOAZ, "Why do you give it the bad name of asbestos, which instantly raises my suspicion?" Then he described the peculiar deposit of magnesia with fine asbestos mixed in, which being worked up from a magnesian limestone, serves as a bond to hold it together; the asbestos while it does not add anything to its fire-retardent properties, makes, so far as I can learn, one of the most extraordinary of the hard plasters for durability and for safety, and I have been greatly hoping that we should hear more of it. Mr. BOAZ went abroad and was taken ill, and for a year I have not heard anything of him.

The PRESIDENT. As I understand this matter, Mr. ATKINSON, in behalf of the insurance companies, as yet does not prohibit the use of steel beams, but their choice would be to use the wooden beam.

Mr. EDWARD ATKINSON. That is it, sir.

The PRESIDENT. And their choice thus far has not changed the rates, whether parties use steel or whether they use wood — not up to the present time—so that it is a matter that is left open for the time being for a man to use steel or wood as he sees fit. Perhaps, later on, when you have had more experience about it, the insurance companies may take a different action in the matter, but I do not know that that could affect the mills that are built previous to that time; it could not justly.

Mr. JOHN E. PREST. Mr. President, I would like to ask Mr. ATKINSON if the fire-proof building of Washburn & Moen, to which he referred, contained sprinklers, and if the sprinklers went off and what the effects were. The question in my mind is, if it was well supplied with sprinklers, plenty of water and steam in the room, whether it would not hold the beam from twisting so as to protect the beam.

Mr. EDWARD ATKINSON. It was one of the cases where it would have seemed almost absurd to us and to the owners alike to require sprinklers. The building was of metal and brick, with the exception of the floors, and part even of the floors were not of wood. There was no combustible material used in it of any kind, and the only burnable things in it were a part of the floors and part of the roof. And yet it was absolutely destroyed by gas generated from a leaky pipe which had conveyed the fuel oil from the pit to the furnaces. As I recall the facts, the pipe had sagged and leaked, and a small quantity of oil converted into gas by heat remaining 16 hours after the fires went out, filled that building, and it went off suddenly. I doubt if any sprinklers would have saved it. It is one of those curious cases of gas explosions that sometimes occur.

Mr. LOUIS SIMPSON. Could it not have exploded and the explosion have destroyed the structure?

Mr. EDWARD ATKINSON. It is not an explosion in the sense of an instantaneous break, but it is the explosive nature of the

fire to which I think we may attribute the few incomprehensible fires that we have had and to which I attribute the fire in the Windsor Hotel and in other first-class dwellings. The contents of any one of your mills may consume in such a way as to generate a gas as well as smoke. If you can find a piece of linen paper in these days of clay, and if you will take it and make a lamplighter, you can perform an old trick that I did when I was a boy. Light the end of the lamplighter, which gives off a light smoke; that is not combustible; but from the other end of the lamplighter there issues a yellow gas which will collect in the palm of your hand, and you can ignite it in an explosive manner: it leaves a yellow stain on your palm.

In the Plymouth Cordage Works the fire was in the picker. There were eleven barrels of fish oil standing by. The firemen were handling the fire with entire success, but connected from the second floor of that picker with the four-story mill was a closed bridge; whoever was in charge of the fire sent a man around to see if that mill was all right, and before a report reached him it was all on fire, all over. The gas that had been generated from the fish oil had passed across this closed bridge, putting into the factory the necessary 9 or 10 per cent. of gas in proportion to the atmosphere, and then that ignited all at once. Sprinklers were distributed on the floor to be screwed up the next Monday morning, the pipes were in and the water behind the valves, yet on Saturday afternoon the mill was destroyed in this way.

I attribute the loss of the Renfrew weaving shed to somewhat similar conditions: that there must have been a slow combustion of the materials in one of these rooms, the gas from which spread through the building, and when the ignition came it went off almost with an explosive virulence that nothing could have prevented.

I was once called to investigate a fire in a neighboring hotel which had endangered that building, and I looked around and said, "What do you use for sweeping the floors here?" "Why, sawdust, of course." "Where do you store your sawdust?"

"Down in the basement." "That was where your fire started, wasn't it?" "Yes." We went down there. It was all black, they had put the fire out, but those barrels of dry sawdust were stored in a basement where they could catch kitchen grease, and I have not a particle of doubt that from that spontaneous combustion of sawdust and grease which so frequently destroys icehouses where the gudgeon grease has gone into the sawdust the fire was generated.

Now take the Windsor Hotel. You have evidence that smoke was seen from the roof 34 minutes before the fire alarm was sounded below, and you have evidence that the hotel seemed to take fire all over at one time. There are the conditions. That was one of the models of combustible architecture: a brick sham, enclosing a timber structure, full of cells connecting from basement to attic. Somewhere in that basement something slowly consumed, the gas generated by that combustion got into the interstices of those walls, showed a little smoke at the roof, and by and by when enough had collected the ignition took place, and the hotel went down all at once.

This is an obscure subject, and whether sprinklers or anything else will take care of you under such conditions is a doubt. Had there been sprinklers where the gas was generated in the Washburn & Moen building, it would have stopped it, but who could put sprinkers over a heating plant of that kind? We were talking of sprinklers yesterday. We have had two cases where if we had had sprinklers over the tail-race we would have been saved two considerable losses. The mills not being in operation, oil on fire backed up into the tail-race in the New Brunswick Hosiery Company after the great accident on the railroad and set the mill on fire, and in the Norwich Bleachery a back-up of burning oil set part of the bleachery on fire. Therefore, I said yesterday, wherever you think you cannot possibly have a fire, put a sprinkler. Put a sprinkler over your tail-races, if you please. We do not urge it. [Laughter.] But after we have done everything that we can do and made every possible forecast that any man can who is thinking about it with his fire

eyes open all the time, you will yet occasionally have a destructive fire.

BYRON WESTON wrote me once that he had protected his mills throughout at every possible point, except the tail-race, and asked me if he should put a sprinkler over that. Evidently he did not expect a reply, but I wrote him, "In your case the fall is too quick." But if we had had sprinklers over the tail-race in the New Brunswick Hosiery Company, you would have saved some money towards your dividends.

I want to add, at Mr. PARKER'S suggestion, in regard to the Washburn & Moen case, that while you may attribute the destruction of that building to gaseous explosive conditions, yet there was heat enough generated to twist those beams into every conceivable shape. It was not simply wrecked; it was expanded and twisted and torn.

The PRESIDENT. We shall have to pass that for the time being, at least. We will take up question 112:

112. What is the best method of coloring the inside walls of mills?

The SECRETARY. I have received the following letter from one of the members whose modesty not only extends to a desire to avoid the meeting, but he wishes not to have his name used, as there is not any claim for originality of the material, but for mill purposes he uses whitewash prepared according to the following specifications, with the exception that a little yellow or blue is added to it.

This person, however, prefers for the inside of belt porches, within five feet of the floor, where the walls are rubbed by operatives, to apply a coat of kalsomine to the brickwork before painting, as it saves a great deal of paint in the prevention of absorption by the brick work.

Slake half a bushel of lime with boiling water, keeping it covered during the process. Strain it and add a peck of salt dissolved in warm water, three pounds of ground rice put in

boiling water and boiled to a thin paste, half a pound of powdered Spanish whiting and a pound of clear glue dissolved in warm water. Mix these well together and let the mixture stand for several days. Keep the wash thus prepared in a kettle or portable furnace, and when using have it as hot as possible.

The foregoing, I was told personally by this gentleman, were the specifications of the United States Government for whitewash for lighthouses and public purposes of that kind.

The PRESIDENT. What is to be said on this subject? Most of us have some kind of a wash for the walls of our mills; at least, we ought to. If there is one wash that is better than another, the party that has that information would confer a favor on the other members of the Association by revealing it. I do not imagine there is any patent on anything of the sort. Any information will be very gratefully received. There are a large variety of washes used for brick walls and plastered walls and ceilings, and merits, of course, claimed for them all. I have used personally quite an extensive number of these various concoctions, and we have come to the conclusion that a preparation that we can make ourselves from lime and glue and other material convenient for use, is quite as useful and practical as any of the other descriptions that we have used. As a rule, I think that the insurance people give a preference to whitewash over the majority of the coloring concoctions that are used. Mr. ATKINSON has just come in; perhaps he can give us a little light upon that matter. The question before the house, Mr. ATKINSON, is, "What is the best method of coloring the inside walls of mills?" I suppose that means, what is the best material.

Mr. EDWARD ATKINSON. So far as a fire retardent is concerned, a good coat of whitewash is about equal to any of the so-called fire-proof paints. The retardation ranges from a quarter of a minute to three-quarters of a minute in igniting the wood under whatever wash is used. Good whitewash is one of

the most effective retardents of ignition along the wall. Where the heat strikes it will go through, but I think it will not ignite with a good coat of whitewash. My choice would be, if I were again a spinner, that which reflects the light most effectually, disregarding any great influence in retarding fire. Where you want to retard fire you will use some other method.

Mr. ARTHUR H. LOWE. Mr. President, I have no particular wash to recommend, but in my mill I require that everything used shall be white, white paint or whitewash. I do not believe in dark paints inside of a mill. We paint for light and cleanliness.

Mr. LOUIS SIMPSON. I would suggest, Mr. President, that if any members have any special recipe that they send it to the Secretary, to be printed in the Transactions. I have one at home, but I have not it here. It is a very simple one, the special feature being the addition of a small amount of Glauber's salts, which is very cheap, so that the white will not rub off easily, and for coloring a small quantity of copperas, which is very cheap also. You can produce any tint you want, from rose up to a dark ochre. I shall be glad to send the formula to the Secretary.

The PRESIDENT. Mr. SIMPSON'S suggestion is a very simple and a very good one. His suggestion is—perhaps you all heard it—that if any members have a peculiar description of whitening or wash for the walls of mills, which they think is better than another, that they send it to the Secretary and have it published in our Transactions for the benefit of all the members. It is an excellent suggestion and I presume there is none of us but will be glad to do so.

Mr. EDWARD ATKINSON. I would like to reqeat the warning on all occasions, proper and improper, against the ordinary varnishes. The ordinary varnishes are most incendiary substances; fire will spread like a race horse wherever they are used, and in

some of your counting-rooms you have been apt to use varnish. We learned the lesson, or *you* learned the lesson, by paying $25,000 on a highly decorated counting-room building where varnish spread the fire.

The PRESIDENT. Would you give as a rule, Mr. ATKINSON, the preference to wash rather than paint?

Mr. EDWARD ATKINSON. I do not believe there is enough difference between the ordinary paints and whitewashes for the insurance man to have much to say about it. I think whitewash is the best, and the receipts, of which I think there are more than one, that will prevent whitewash from rubbing off, render it, I think, unobjectionable. I have an idea that there are facets reflecting light from whitewash more than from paint, but I leave that for you to think of. Oil paint should never be used on green timber. It will cause it to rot in less than three years. There are several excellent water paints for inside use.

TOPICAL QUESTION.

113. How can a card room be ventilated without undesirable currents of air?

The PRESIDENT. Are there any remarks to be made on this question? It would really seem that questions that are presented to the Board of Government to be considered here ought at least to receive attention from the party who sends these questions in, if we cannot get any information from anybody else. It is a waste of time and paper and ink to print these questions unless they can be discussed. I hope that some light may be thrown upon the present question; it is one of considerable importance.

Mr. EDWARD ATKINSON. Mr. President, I do not like to push in, but the question interested me very much, and I hope to get some light upon it from those who have proposed it.

There is one way in which, in my judgment, all card rooms may be ventilated freely without any currents of air that will affect the stock, and that is by a plant of Cyclone dust collectors, corresponding with those which have been put in some of the napping rooms. The whole difficulty is the expenditure, I believe. I brought that Cyclone dust collector idea from the West many years ago. One of the first places in which it was adopted was in the picker of the Stark mill. Our friend [Mr. STEPHEN N. BOURNE] can tell us about it. From that it went into many other places, and finally into the napping rooms of several of our mills. I have not the record, but we used to wonder why the napping rooms did not blow up, and I also wondered how any human beings could work in them. They are, as a rule, now entirely clean and free of dust. The method is not a difficult one. Of course, apparatus which does not cause the flow of fine flour to run away from its right lines in a flour mill will not interfere with the movement of card sliver in a card room, and I have been trying to get some one, especially of our knitting mills where mixed stock is worked on open cards, to go into this matter. It is one that you all ought to consider, not only with reference to danger, but also with reference to the health of the operatives. The constant breathing of fine fibre cannot be wholesome, and if it can be removed a little extra expense is desirable, and I have no reasonable doubt that if the napping rooms, which have been completely cleared, were made the base of a study, you would find how to clear your card rooms absolutely.

Mr. LOUIS SIMPSON. It may interest the members, Mr. President, if I inform them that it was the intention of my company to put such an arrangement in our new mill. If, therefore, the Association comes to Canada in the autumn, I hope to be able to show them one working. I intended to put the Cyclone separator in the picker room and so provide the picker room with air that the fans on the pickers should take it away. I was going to try and kill two birds with one stone.

The PRESIDENT. Mr. ATKINSON referred to the Cyclone dust collectors introduced at the Stark Mills by Mr. BOURNE. I have had occasion within the last two weeks to investigate that matter somewhat. Have been erecting a new plant for opening, cleansing and picking of cotton, and the proprietors of the Cyclone dust collector referred me to Mr. BOURNE at the Stark Mills. I corresponded with Mr. BOURNE, and perhaps he will give you something of his experience in regard to it. If what the proprietors of that apparatus claim for it can be accomplished, it seems to me it is well worth adopting, both for better ventilation, cleanliness, and, as Mr. ATKINSON has suggested, for the health of the operatives. Will Mr. BOURNE give us any information?

Mr. STEPHEN N. BOURNE. Mr. President, I have experimented with these Cyclones and I have them in use, but the results, I might say, are very much the same as where you put some attachment on a single machine—a loom, for instance—and you look at it and say it goes first rate, but when you come to have thousands of them, you might find difficulty that we have not struck. I put the Cyclones on as an experiment. Our present dust room takes one story of our mill, and I put this apparatus in, believing that business was going to be better and that we should need to extend, and I was anticipating using that room for machinery. So I put in one set of pickers, one breaker and two finishers, and connected them with one of these Cyclones. We ran afoul of some obstacles, which we remedied: among others, we found that we could not have that Cyclone out in the cold. Being in the warm air inside and the cold air outside in cold weather, we found then there was trouble.

The PRESIDENT. Condensation?

Mr. STEPHEN N. BOURNE. Condensation. The dampness would make this lint collect on the side of the Cyclone. Then I made a hole through the roof and let it quite a way down, six feet below the roof, so as not to have so much of that tapering

part where it collects exposed to the cold, but have it down where it is warm. Above that, where it collected on it, I lined it with wood to keep the dust from collecting on it.

The PRESIDENT. This collector was made of galvanized iron?

Mr. STEPHEN N. BOURNE. Galvanized iron. After doing those things this collector has run with those machines for four or five or six years. I put it in another place; that is on a shears from the cloth room. The lint from that used to go out and be blowing around the yard, and I put the collector on that in a little room, bricked it in so that it has been perfectly satisfactory to Mr. ATKINSON'S men who have been around and said that is a model dust room. That has worked splendidly. All the dust that comes from the shears comes down into a bag. All the man has to do is to take it once a day and carry it off in the bag. The place is perfectly clean, there is no dust flying around the yard. I am very much pleased with this as far as I have gone, but I do not want to say it is just the thing for everybody and in all places. But there is one thing: in cold climates you must have them where you can protect them from the weather.

The PRESIDENT. The agent whom they sent me proposed to put this dust collector on top of a dust tower that we already have for the ventilation of the dust room, and in your estimation that would not be a suitable thing to do for the year round?

Mr. STEPHEN N. BOURNE. I should not think so.

The PRESIDENT. This question, of course, as it stands, is the ventilation of card rooms, and our remarks now seem to me perfectly proper and pertinent in connection with this question, having reference to the picker rooms as well. It was for a picker room and an opening room that I was investigating this matter, and it seemed to me that where the difficulty would arise was in this way: the agent proposed to put in a large fan, an eleven foot fan, in the basement where we now discharge our

dust—by that means he would save us that room—and discontinue the use of the fans on the pickers and openers. I asked if he did that whether he was sure that he could give us a sufficient amount of draft and ventilation to take the dust all away. He said there was no difficulty about that; he would guarantee to split the laps, if we wanted it as strong as that, on any machine that we had. Then it struck me that the objection to that was going to be, if we put that on a series of lappers, that occasionally one or more of those lappers would stop—one, two or three, as the case might be—and if all this draft was concentrated on the one or two, three or four, as the case might be, lappers that were left running, that we would have that very difficulty of splitting the laps and injuring the work. I suggested that to him, and he said to overcome that they put a damper in the flue. But unless that damper could be automatic, unless the experience of the Association is better than mine, it is not always easy to get hands that will tend that damper every time they stop the lapper, and it struck me that for that very reason it was hardly practical to attach it to a large number of lappers all connected with one flue. Of course if one put in a series of these machines they could be adapted to every lapper and perhaps overcome the trouble. I do not know that I am right about that, but I felt that so strongly that I had almost abandoned the idea and thought of building another dust tower to try and take the dust out in the old way.

Mr. STEPHEN N. BOURNE. If Mr. WHITIN is in the room I should like to call his attention to this. We thought about putting on a fan, so we procured fans and experimented in different ways and put this temporarily outside the building, and we came to the conclusion that the best way was to keep a picker about the way it was designed, and if we could not adapt it to the way the machine was designed it was no good. And we could not make the fan go; we were satisfied it was useless and we stopped it.

The PRESIDENT. Did you use a large fan in connection—

Mr. STEPHEN N. BOURNE. I had one on hand that was big enough to more than equal those fans that we had on the pickers.

The PRESIDENT. You kept the fans still running on your pickers?

Mr. STEPHEN N. BOURNE. We stopped the fan and we ran the fan; we tried all sorts of ways. If you can tell us anything that we did not try—

The PRESIDENT. You only had it on one machine, as I understand?

Mr. STEPHEN N. BOURNE. Our machines run in sets of three, a picker and two finishers, and those three machines all exhaust into one pipe—one exhaust pipe or flue that goes to the dust room.

The PRESIDENT. What would be your opinion if we should put that on to a large collector and run a large number of lappers all into one flue?

Mr. STEPHEN N. BOURNE. I should not think it would go.

The PRESIDENT. You think there would be the difficulty that I suggested?

Mr. STEPHEN N. BOURNE. Yes, I think so.

The PRESIDENT. I felt afraid of that. Of course I did not know; it was a matter of speculation.

Mr. EDWARD ATKINSON. It had never occurred to me that this method could be applied to removing the dust from a picker machine. My point is to remove dust from the rooms which are prevaded with the waste from the napper, from the picker, or from the card; quite a different problem. I should doubt very much whether any dust collector could be substituted for the present fans on picking machines. The card room problem

is an entirely different one. Bear in mind that in these huge flour mills, which are bigger than almost any of your card rooms, that explosive flour dust which used to blow them up has been absolutely taken away. The air is passed through these collectors — the whole atmosphere of the room — without making any current that in the slightest degree alters the direction of the little streams of flour. I wish I had prepared by getting from one of the mills that has applied this to the napping room a complete plan and description. I have no doubt if you carry this subject over to the next meeting you can have a great deal more light upon it. I would also say that the Cyclone dust collector is not the only one. There are several very ingenious inventions in the West devoted to the same purpose.

Mr. LOUIS SIMPSON. I have three collectors, one in the factory, one in the napping room, and one which takes the dust from the shears. The one I have in the napping room I have inside the room, and it deposits the waste that it separates into a tin box which I clean out every day. I have no trouble at all with that. We just closed a contract a month ago to use collectors on our picker room, but we are going to have a collector to each machine. I intend to leave the present fans on the machines, and by doing that we shall require very much smaller fans to drive the dust through the collectors. It is on the same principle as when you are pumping water under a head, the pump will pump a great deal more water than when the water is down below. I think it would be a very serious mistake to try and work a large plant from one big fan. You would not have regular work in your card room. As the picker room is one of the most important points in any mill, so it is very necessary indeed that you should have your arrangement so that you should have the laps go to the cards regularly. I think myself when you see the installation I am putting up — of course I am only speaking now from theory; in the course of two or three months we will have the actual result; but I think you will find it will work well in your own plant. I shall be pleased to show it to you. I may say that the Dominion Cotton Company in Montreal is

also adopting the same system, so that we are likely to have in Canada the thing tested thoroughly this year.

The PRESIDENT. I am aware that the question before the house and the question propounded on this paper alludes simply to carding rooms, but inasmuch as this new system is being brought into prominence and to be adopted or recommended to be adopted for picking purposes, I thought it might be of interest to the whole Association, and if parties had had any experience in that direction it would be very desirable to obtain that information at this meeting. I am aware that it is digressing a little from the question, but sometimes we can digress to our advantage. I thought that this might be one of the cases.

Mr. FRANK A. BOWEN. Mr. President, having had some experience in the application of this dust collector in connection with napping rooms, it may be of interest to give my experience in that regard. In the concern I am with we have eight of these collectors, connected with French nappers, and it seems to me that in considering these appliances with the subject before us the point would be "without undesirable currents of air." Those who have had experience with these dust collectors know that they are connected directly with the machine, and in the French nappers are connected with a hopper that is built in underneath the worker rolls and the lint is drawn directly from the workers through the flues and into the collectors. There is a very strong current of air generated in connection with those flues. We also have openings in the flues where the sweepings from the floor are taken up, and there is such a strong current that it will lift lint a foot from the floor up into the flues. The gentleman, Mr. STEPHEN N. BOURNE, spoke in regard to lint collecting on the inside due to moisture where the collector is placed outside of the building. In my opinion one of the main points in favor of these collectors is that they return the same air back to the room that the dust is carried away by. Of course there will be quite a serious objection, in cold weather

especially, to the drawing of cold air from outside to supply the draft to the fan, and then this warm air that is taken from the room thrown out, and it seems to me that it would be quite an undertaking to connect these strong draft fans with the carding room without disturbing a great deal of the fibre and depositing more or less of it in whatever is used to collect it. It might entail a considerable loss of material.

The PRESIDENT. Your idea is, as I understand it, it would be perfectly practical to apply this apparatus to individual machines?

Mr. FRANK A. BOWEN. Yes, sir.

The PRESIDENT. But not practical to apply it to the room at large?

Mr. FRANK A. BOWEN. No sir. There might be an opening underneath a revolving flat card for instance, that would carry away all the dust and waste that would naturally be deposited on the floor.

Mr. EDWARD ATKINSON. I would say finally, the thing that first attracted me in Minneapolis was the fact that the air of the room without being changed, could be sent slowly through these dust collectors, leaving behind the dust. Of course they would be adjusted in speed and power of fan to different conditions, but the very first motive that I had in bringing the idea this way and applying it was to save the heat and clear the air, by pumping the current of air—the air of the specific room—through the dust collector and back into the room, leaving the dust behind. If they can do that on flour I think you can do it in the card room.

Mr. JOHN ECCLES. Some years ago we placed fans in our mule room for the purpose of reducing the heat, but were obliged to discontinue their use owing to the draft they made which interfered with the long stretch of delicate threads. We took these out, stowing them away in our store room. The

past year 1898 we decided to try them in our carding room and found a great benefit, as Mr. ATKINSON has said, by purifying the air of the room. They also removed a quantity of the dust, improving the air considerable. This is what the topical question alludes to. We find no inconvenience from the draft in the card room; are considering the wisdom of increasing the number. We put two in our frame spinning room which is extremely warm, in the centre of the room. Our girls noticed the difference in the air, being purer. I thought they looked brighter and healthier after the fans had been in use for a few months. The topical question does not refer to these rooms but are for the picker rooms. Think it not out of place to mention our experience.

Mr. C. J. H. WOODBURY. Mr. President, when I was in England several years ago I saw in a number of cotton mills a method of ventilating card rooms in warm weather by which opened windows would not interfere by blowing the fluff, merely by taking out the upper row of glass in the upper sash, and putting in an inclined sash like an open transom above a door which was closed at the sides and there was a hinged cover on the top of it. When this cover was opened the air would strike the inclined sash and be deflected against the ceiling and make the circulation in the upper part of the room without having any high velocities, which is what must be avoided in ventilation. During the past summer, July was hot and humid and very severe upon everybody; especially there was difficulty in a room where there were a large number of clerks employed in sorting over small pieces of paper. If the window was opened the papers would be blown around, and if the windows were closed the help would suffer. There were so many of the papers that it was unfeasible to use paper weights in such number as would have been necessary, and I made a satisfactory change by putting some deflectors of manila paper at the upper sashes of the windows, blowing air in that way right against the top of the room. Then the door was equipped with a curtain like those of the old-style

restaurants in Boston with stalls. This curtain was made of paper and drawn low enough to cause the air to go out of the room near to the floor; and the air being deflected from the ceiling coming down upon those papers, we had an ample circulation of air in the room without any disturbing current. In short, the room was ventilated by a directly downward current of air, like the Irishman's breeze which "blew up and down the mast."

Mr. EDWARD ATKINSON. I make the final suggestion, Mr. President, in connection with this, that in such periods as that of extreme humidity and warmth those of you who run mills by water power had better tap the space over your tailraces, and take in the air that has been sucked down with the water rushing out through the tailrace in a cool draft, as you all know, and convey that cool, dry, clean air into your rooms. Why not? Put a little air dam at the mouth of the tailrace, so that when the air that has been drawn down through the wheel pit tries to get out on top of the water it will meet an obstruction. That obstruction in itself, I think, without any fan, will be sufficient to force it back into a mule room or into a weaving room and give you a very desirable atmosphere in dogdays at very little cost.

The PRESIDENT. I think in referring to the matter of ventilation it is becoming quite common for newly constructed mills to arrange their windows so that the bottom sash is permanent and there is a transom sash at the top. I have had but little experience, but have just been constructing a room such as I am speaking of, and have abandoned the idea of a Cyclone and put those sashes into that room. Instead of hanging them as you do an ordinary transom, at the bottom, I hung them in the centre; putting an arrangement on by which the windows can be swivelled. I don't know that theoretically that is just the proper thing, but practically it is working very nicely with us. We are getting very much better air in the room and are freed to a very large extent from the objectional dust that we attempt

to take out with the Cyclone collector. So far as my experience has gone it is new, it is only recently that I put it in, but it has worked very satisfactorily with the transom hung in the centre, swinging the bottom out and the top in. So far we have very satisfactory results from it.

The next matter on our programme is a series of papers on the electrical transmission of power namely: papers on "Auxiliary Power Plants with Electrical Transmission at Grosvenor Dale and Lyman Mills," by FRANK P. SHELDON, Providence, R. I.; "The Advantages of the Electric Driven Cotton Mill," by W. B. SMITH WHALEY, Columbia, S. C., and "Fallacies Concerning the Electric Drive," by SIDNEY B. PAINE, Boston, Mass. The first is the paper by Mr. FRANK P. SHELDON.

The Secretary read Mr. SHELDON'S paper which was as follows:

AUXILIARY POWER PLANTS, WITH ELECTRICAL TRANSMISSION, AT GROSVENOR DALE AND LYMAN MILLS.

FRANK P. SHELDON, Providence, R. I.

Both these installations of auxiliary power furnish some points that may be interesting to manufacturers, the problems presented being of a nature that may often arise in mills where the water power is fluctuating and inefficient.

At Grosvenor Dale, the problem presented was this: there are three separate falls on the stream, at each of which was located a mill. The upper fall has about 1,100 horse power, the central one about 300 horse power, the lower one about 450 horse power. The mill at the central privilege was too small to be operated with profit (about 17,000 spindles), and it was decided to dismantle it, and utilize the power for an electric light and power station for the other two mills. As the water power of New England streams as a rule is low in the summer months and lighting is wanted chiefly in the winter months, the conditions of the supply and demand for power and for lighting fitted the conditions of the two seasons very well.

Having the electric light plant installed, it was a simple and comparatively inexpensive addition to it, to install motors for supplying power. The same apparatus at the electric station and the same wiring to the mills would be used, and the only additional expense would be for the motors. The cost of the power transmission plant alone was less than half what it would be if the whole plant had to be installed for power only, and several times less than it would be if the water power had also to be developed. In the latter case the cost would be prohibi-

tory as compared with steam power, which is produced at these mills at very low cost. All the conditions in this case seemed to fit admirably with an electric plant for lights and power and it was decided to make the installation.

The apparatus was all furnished and installed by the Westinghouse Company. The electrical equipment at the central station consists of two 150 kilo watt two-phase alternating generators, 2,200 volts, with proper exciters, marble switch-board and instruments. At the lower mill were placed 1,000 sixteen candle power lamps, with two 500 light transformers. At the upper mill were placed 2,200 sixteen candle power lamps, with four 500 light transformers and two 250 light. Also, two 100 horse power two-phase rotary field motors, speeded at 720 revolutions per minute, located in the engine room and belted direct to one of the main jack shafts. Also a 10 horse power motor in the cotton house.

The line consists of four No. 6 wires to the lower mill, about 1,800 feet distant, and four No. 4 wires to the upper mill, about 6,000 feet distant.

The equipment was guaranteed to operate successfully under a maximum variation of 3 per cent. in speed of engines at the upper mill, and of 5 per cent. of the water wheels at the electric station. The results have proved entirely satisfactory. The motors have often worked at 30 per cent. and 40 per cent. overload.

An engine was installed at the electric station, to enable the lights to be run when the water power failed.

An interesting and novel feature has developed in the practical operation of this plant, and which was not foreseen by the makers of the electrical outfit, and so far as I know has never before been observed or at least reported in commercial practice. The custom was to throw off the motors just before the lights were turned on, as the wheel power is not sufficient for both. One afternoon by some neglect, the motors were not thrown off. The result was, that as the lights increased, the wheel became overloaded and the speed fell off gradually. The

result was, of course, to reduce the voltage on the line. But as the motors were connected to the mill shafting, driven by a powerful engine, the motors were held up to their normal speed, and it was found that they automatically reversed their action, and acted as generators, delivering current into the line sufficient to maintain the voltage and thus relieving the wheels, and enabling them to keep up their normal speed. The discovery of this phenomenon was accidental, but it has proved to be a very convenient feature in operating the plant, and has since been taken advantage of in daily practice, as it affords a very nice automatic regulation, enabling the full power of the wheels to be utilized; the regulation of the voltage and the reverse action of the motors being perfectly automatic.

THE LYMAN MILLS PLANT.

These mills require about 2,200 horse power to operate them. The water wheel plant is capable of driving the whole mill, when there is plenty of water. But in the year preceding the installation of the auxiliary power, the stoppages of the machinery from deficient water had reached a serious and intolerable point, and it was decided to install some sort of auxiliary power. There being considerable unoccupied floor space in the mills, power was also to be provided to drive the machinery which might be added at some future time. An electric light plant was also wanted, for about 3,000 lights.

There are four separate mills, one of them at right angles to the other three, also machine shop and cloth room buildings, the latter on opposite side of canal from the mills. The cloth room was driven by a long shaft from No. 2 mill, extending through a tunnel and over the canal on a bridge. The shop was driven by a small non-condensing engine. There were water wheels in each of the mills, and an auxiliary wheel between No. 2 and No. 3 mills. There was a deficiency of power in all of the mills at times, except in No. 4. In this mill there was a surplus of power for its own machinery, and part of its

power was carried into No. 1 mill at right angles, by a quarter turn drive. The unoccupied floor space was in No. 4 mill.

It was impossible under the existing conditions to locate an engine where its power could be taken directly by belts to the places where it was wanted. And as the amounts needed in any one point were small, there seemed to be no way to accomplish the results except by electrical transmission. As the larger part of the auxiliary power, however, would eventually be used in No. 4 mill, it was decided to locate the engines so as to drive directly into the mill by belts on the main jack-shaft. This would take care of about 600 horse power by a direct drive. The power wanted in all other places was to be distributed electrically, by motors of various sizes, located in the rooms where the power was wanted. In all, there were about 700 horse power to be provided for, but only one-half that amount was needed at present, until the unoccupied floor space in No. 4 mill should be taken up.

On this account, and also on account of the fluctuating demands for auxiliary power, it was decided to install two small units rather than one large one. The engine already installed is a 350 horse power tandem compound condensing, made by the Allis Company, Milwaukee, Wisconsin, speeded at 120 revolutions per minute, with a pulley fly wheel for 30-inch belt, which connects to the main jack-shaft in No. 4 mill. Mounted upon the shaft is a 200 kilo watt alternating two-phase generator, with 3,600 alternations per minute. As in the Grosvenor Dale case, the deficiency of water power occurs as a rule in the summer, when lights are not wanted, and the whole current of the generator can then be used for motors. In the winter months, when as a rule the water is ample, there is sufficient margin in the generator to run what lights are now installed In addition to the motors that will be needed, and the margin for about 40 per cent. overload in both engines and generator.

When the time comes for installing the second unit, it can be made of the samc size as the present one, or smaller or larger, as the existing conditions at that time shall require.

The two-phase system was selected for these installations, in preference to three-phase, because a large proportion of the current is used for lighting, and it seemed to be more important to gain the good regulation for this purpose by the use of the two-phase system, than to save copper in the line by the use of three-phase.

The results attained by this installation are:

1st. Ample auxiliary power to enable the mill to maintain full speed and product.

2nd. Its concentration in one place, and distribution to the several points where needed, by mechanical transmission where it is possible and by electrical where it is not; thus combining the economical advantages of the former with the convenience and divisibility of the latter.

3rd. The elimination of quarter-turn drives and the long shaft across the canal to cloth room.

4th. An electric lighting plant for the entire plant by a small additional outlay, as a portion of its cost is included in the outlay for power.

The following illustrations show the principal apparatus used in these two installations.

FIGURE 1,

150 K. W. TWO-PHASE GENERATOR, GROSVENOR DALE MILLS.

FIGURE 2.

DIRECT CURRENT EXCITER, GROSVENOR DALE MILLS.

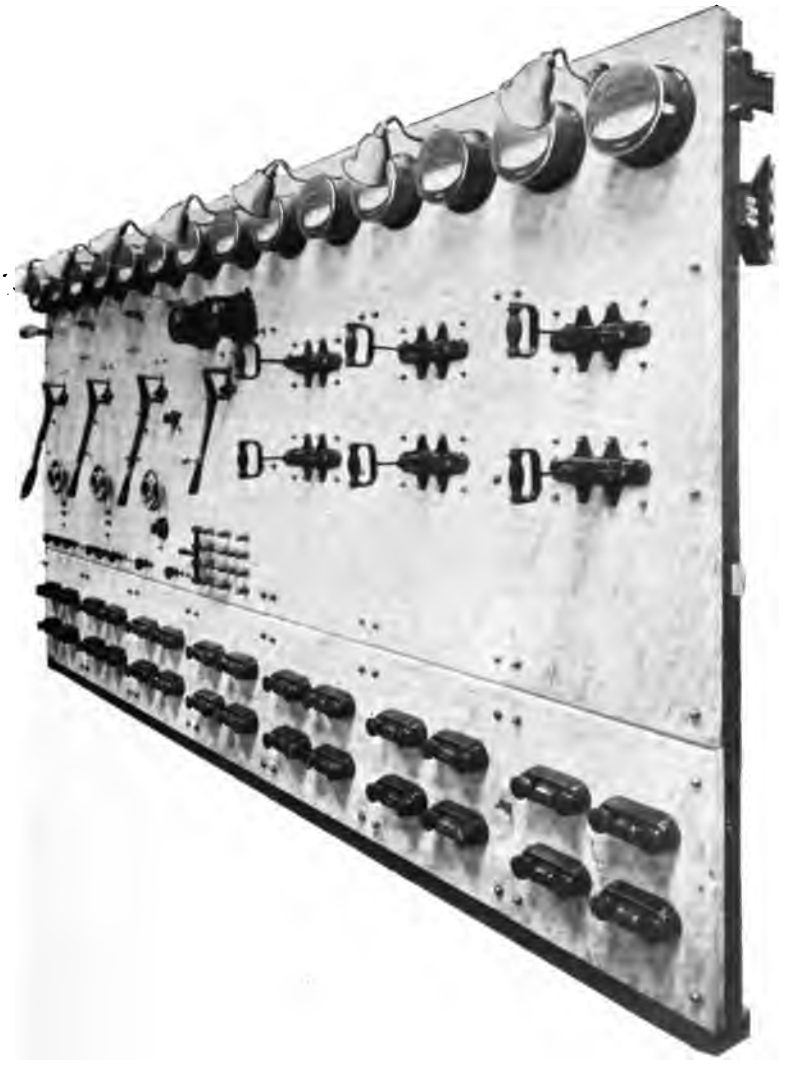


FIGURE 3.

GROSVENOR DALE SWITCHBOARD. FRONT VIEW.

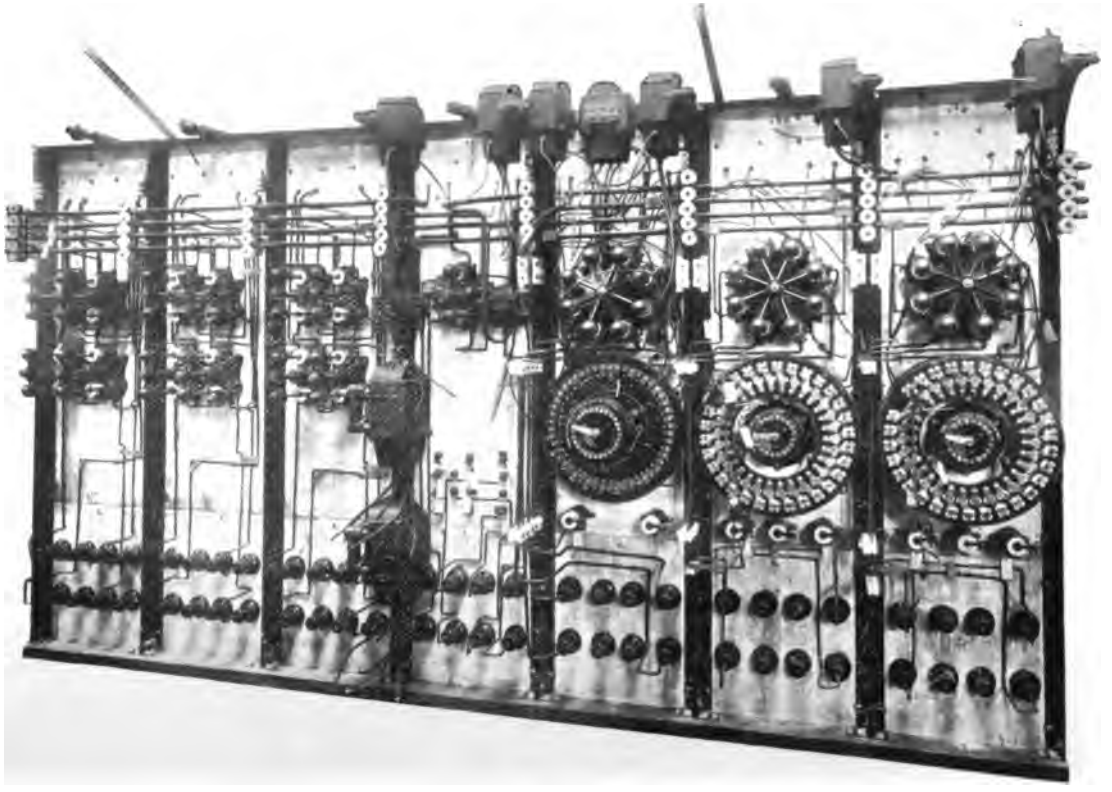


FIGURE 4. GROSVENOR DALE SWITCHBOARD. REAR VIEW.

FIGURE 5.

LOWERING TRANSFORMER, GROSVENOR DALE MILLS.

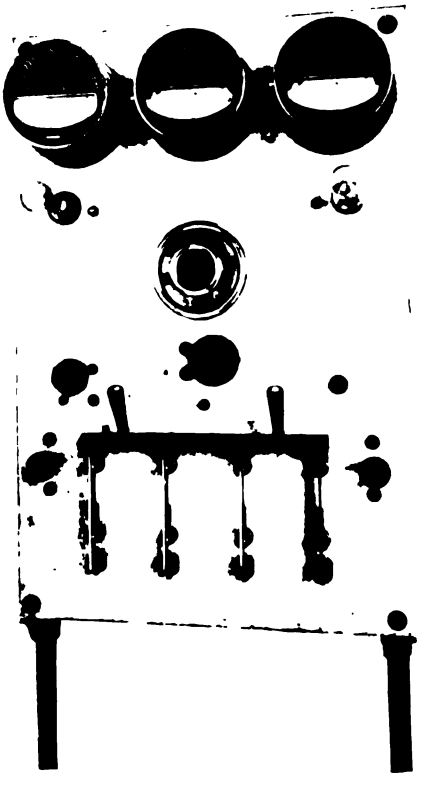


FIGURE 6.

SWITCHBOARD, LYMAN MILLS.

FRONT VIEW.

FIGURE 7.

SWITCHBOARD, LYMAN MILLS.

REAR VIEW.

FIGURE 8.

75 HORSE POWER MOTOR, LYMAN MILLS.

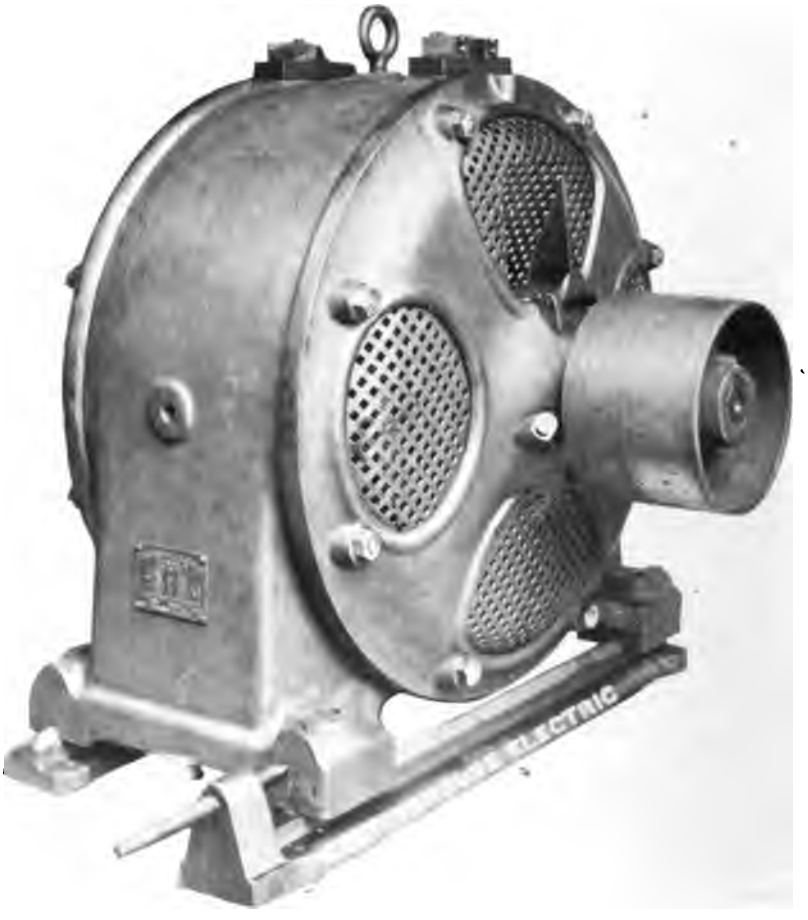


FIGURE 9.

30 HORSE POWER MOTOR, LYMAN MILLS,

FIGURE 10.

PRIMARY ELEMENT 30 HORSE POWER MOTOR, END CASINGS REMOVED, LYMAN MILLS.

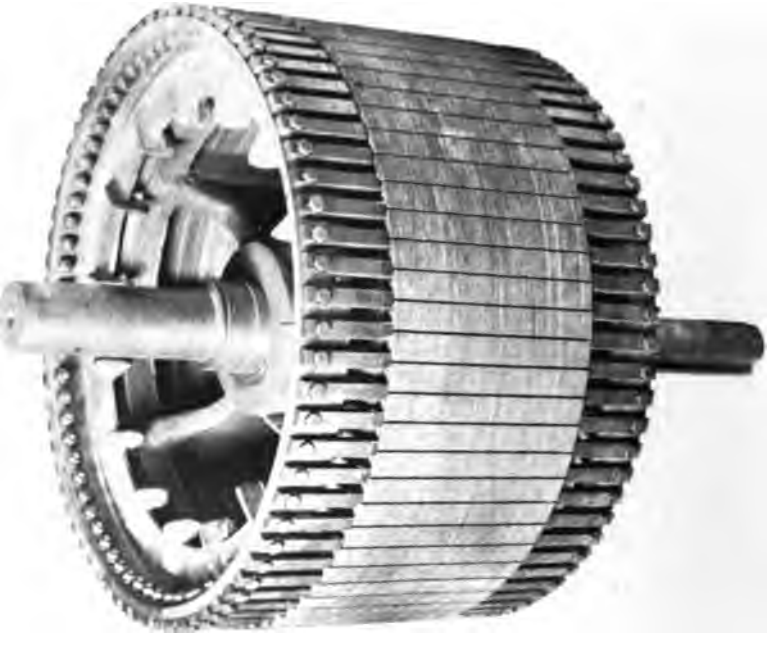


FIGURE 11.

SECONDARY ELEMENT, LYMAN MILLS MOTOR.

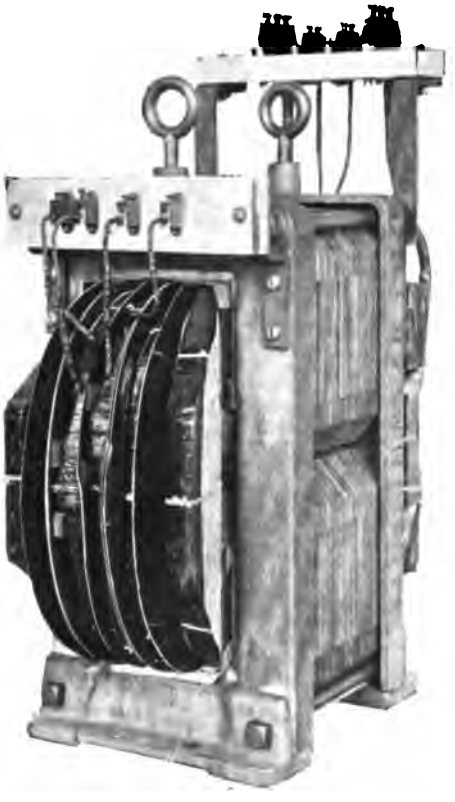


FIGURE 12.

LIGHTNING TRANSFORMER, LYMAN MILLS.

FIGURE 13.

LYMAN MILLS TRANSFORMER IN CASE.

The PRESIDENT. In connection with this same paper from Mr. SHELDON, we will hear a paper on "The Advantages of the Electric Driven Cotton Mill," by Mr. W. B. SMITH WHALEY, of Columbia, S. C.

THE ADVANTAGES OF THE ELECTRIC DRIVEN COTTON MILL.

W. B. SMITH WHALEY, Columbia, S. C.

It is not the purpose of this paper to describe an electric driven cotton mill, that subject having been previously dealt with in other papers presented to the Association at past meetings, but rather to describe the advantages that may be gained by the operation of a mill by electrical transmission of power.

Taking these in their order, we first find a greater economy in floor space, due to the absence of belt or rope ways, or towers, which gives an advantage in the greater compactness of the machinery space, and the entire absence of any attention to this department. The substitution for these of the wiring for the motors and the suspending of the motors throughout from the beams overhead, requires no special attention and occupies no floor space. The large belts are entirely superseded by smaller ones, easily put on, and suitable for the sub-division of the power and size of the motors which seldom exceed in good practice today, where a mill in the beginning is designed for electrical transmission, 150 horse power in size and consequently six-inch belt is the largest belt that would be used, when one belt is taken each side from each end of the motor.

Secondly, in the greater convenience and flexibility in the distribution of the power; the wires being run overhead on the ceiling take up practically no space, and they can be con-

veniently carried to any place in the building. The motors are designed of suitable size, according to the sub-division of the different departments. In the best practice, the power of each motor would be limited by the smallest size of shafting suitable to span the bay to which the mill is built, with the advantage of shafting of uniform size throughout the plant, and complete duplication in size of hangers, and bore of pulleys. The only variation from this necessary would be the receiving shaft from the motor, which would be made heavy enough to stand the strain of the larger pulleys receiving the power. The turning of angles, where required, is more conveniently done by means of a motor driving the shaft so placed, than by means of mule pulleys or other gearing, with the advantage of increased friction. The transmission of power to adjoining buildings, or buildings apart from the main building, is more conveniently accomplished by means of the electric motor, than the usual methods of belt holes or shafting through walls or exposed shafting or outside gearing, with the advantage of more complete isolation and less fire risk in these departments.

Thirdly, the power for the different departments being distributed by independent motors, the variation in speed due to the operation of the different machines is not felt beyond the sub-division of the power driving that department, and consequently the efficiency of each department is maintained at its maximum. The pickers and openers being generally the machines requiring the greatest amount of power per machine, the variation in power due to the starting or stopping of the machines, does not affect any other department; and the convenience of being able to shut down or run this department ahead, without interfering with the balance of the mill, is an advantage. Similar advantages may be claimed for all the other departments throughout the mill. Should the necessity arise for operating any section longer than the rest of the mill, or stopping any part of the mill, there is a considerable gain effected in the saving of all unnecessary friction in operating idle shafting and loose pulleys. The uniform rotary motion of

the motors, and consequent steady speed, permits a greater efficiency in the machinery resulting in larger percentage of production, and more uniform tensions, and considerable reduction in the wear and tear and supply accounts.

Fourthly, with regard to the necessary attention required by the power plant and distributing motors, there is considerable economy. The electric generating plant, having no connection with the mill, except by means of conducting wires, is much more easily and cheaply maintained than the usual method of driving by means of ropes or belts, and fly wheel. There is no dust, dirt or lint being continually stirred up by fly wheel and belts, requiring constant attention to keep machinery in the power plant clean. There is no pull on the bearings, due to unnecessary straining of ropes or belts and consequent heating of journals and waste of oil. The entire generator simply turns in its bearings with its own weight, and consequently the oil is reduced to a minimum, and there is no external cause to produce heating.

The motors in the mill are easily maintained, and are oiled no oftener than it is necessary to oil shafting in good practice, they being extremely economical is this respect, and the only attention that they require is to free them at times from excessive accumulations of lint.

The foregoing applies to electric driven mills that are designed in the beginning for electric transmission, but not to mills where electric transmission is substituted for ropes and belts, because there can be no saving in initial expense of rope or belt ways, nor can the sub-division of the departments be as economically arranged for maximum efficiency. It is invariably the case in instances where electric power is substituted for direct driving, that the motors are placed on the receiving shafts in place of receiving drums, and no flexibility is gained throughout the plant, except in so far as the isolation of departments driven from separate head shafts; and in many cases it. is a question whether any advantage could be gained, unless such advantage could be shown in power cost. In many instances, investors

are misled by the price of current per unit of power, and the average mill man may be liable to figure this as economical, where in many instances the price quoted appears to be very low; the actual cost of the power is really higher when wear and tear and depreciation (which is low in an electric driven mill), heating and attendance, are added to cost of current. And, where the mill is designed in the beginning, the price quoted may often be made economical owing to the initial saving in the cost of the plant; the same price would not be economical for many modern mills already geared with steam or water.

The PRESIDENT. The next paper in the same connection is, "Fallacies Concerning the Electric Drive," by Mr. SIDNEY B. PAINE, of Boston.

FALLACIES CONCERNING THE ELECTRIC DRIVE.

SIDNEY B. PAINE, Boston, Mass.

Four years ago it was my privilege to read a paper before this Association on "Electrical Driving of Textile Establishments." The discussion of that topic was more or less of a general nature, as the first mill to adopt the system had been in operation only nine months. The purpose of the paper was to introduce the electric drive to the members of the Association, with the expectation that longer and more intimate acquaintance would result in a justification of the position therein taken. In this I have not been disappointed, as there are today more than a score of textile manufacturing establishments alone, using about thirteen thousand horse power in motors. Since its introduction, however, the system has met with some criticisms on the part of those who have not tested it. This is not to be wondered at, as the writer himself did not fully grasp its possibilities four years ago, and frankly admits that he has yet much to learn of ways in which it may be applied.

It is the purpose of this paper to discuss the criticisms above referred to, which are evidently based upon a misconception of the system and its functions.

FIRST FALLACY.

The electrical drive is advantageous only in special cases.

This was a very reasonable criticism at the start, as naturally the first mills to adopt it were led to do so by the successful manner in which it solved certain difficult problems con-

nected with the mechanical drive. The COLUMBIA MILLS, Columbia, S. C., for instance, were located on the wrong side of the canal for a mechanical drive, the canal being between the mill and the river. No other mill site was available. At Taftville, Pelzer, Bondsville and Anderson, the water power was situated about five miles, three miles, half a mile, and ten miles, respectively from the mill. In other mills, an overloaded wheel or engine has been relieved by the transfer of the load to a source of power previously delivering less than its capacity. In one mill, which has been built less than two years, a change in the market demanded the manufacture of different goods from those originally proposed, and more power was required in certain sections than had been allowed for. In another case, a room was made available for a weave shop, to which it would have been impracticable to transmit the power mechanically. The electric drive was adopted in these early plants for special reasons, but it does not necessarily follow, as these critics claim, that the system is therefore advantageous only in special cases. In every case, so far as records have been kept, the system has proved satisfactory and unexpected benefits have been obtained. This will be referred to later.

SECOND FALLACY.

That the efficiency of an electric drive cannot be as high as that of a well designed mechanical drive and therefore it cannot compete with the mechanical drive.

It has been claimed that the losses in the generator, wire and motors, added to the mechanical losses present in every electrical drive, amount to more than the mechanical losses incurred by the use of shafting and belting. This would be true if the mechanical losses in the two cases were the same. As, however, one of the inevitable results of a subdivided electric drive is the omission of much shafting and belting, and the reduction in the size and weight of the remainder, it is obvious that this cannot be the case. For instance, at PELZER where 2,600 horse power in motors are in use, the widest belt in the mill measures eight inches. On an electrically driven spinning

frame, when the motor is directly connected to the cylinder shaft, with the generator directly connected to the engine or water wheel, *all* mechanical losses (outside of the generator and motor) are saved, except those in the engine or wheel and in the spinning frame itself, In this case, between the engine shaft and the spinning frame shaft, there would be a total loss of power of about 21 ½ per cent. At the LANCASTER MILLS, Clinton, Mass., where large motors only are used, the efficiency of the plant, as a whole, between the engine shaft and the motor pulleys is 84 per cent. About the same efficiency is found at the Columbia mills. The efficiency of an electric drive can be readily determined. On the other hand, it is very difficult, if not impossible, to determine with equal accuracy the efficiency of a mechanical drive. The method usually adopted, of indicating the engine with the belts on the loose pulleys, is faulty, for power is lost due to increased slipping and creeping of the belts, when loaded. This is an actual loss and is equal to the percentage of slip. If there is a 5 per cent. loss of speed between the friction load and the full load, there is a loss of 5 per cent. of the power transmitted which has been expended in heating the belts and pulleys. Again, the ratio which the power delivered by the prime mover bears to the amount realized at the machines, is constantly changing. It is not the same today that it was yesterday. Temperature and humidity affect it as well as the condition of the bearings and the alignment of the shafting. This last item has a much larger importance than is usually attributed to it. Many an overloaded engine has been relieved by a correction of this evil. No foresight can prevent it. It is the inevitable result of the settling of the building, and of the constant vibration and strain. It requires continual watchfulness and expenditure, or it will seriously increase the losses of transmission, and also affect the output by overloading the belts, thus causing them to slip, with consequent reduction in speed on all the machines driven thereby.

There can be no question that as ordinarily determined, the

measured losses of the mechanical drive are much less than the actual. Until such time as a method is found of determining with accuracy the actual value of the mechanical losses, it must remain an open question as to how much more efficient the electric system is than the mechanical.

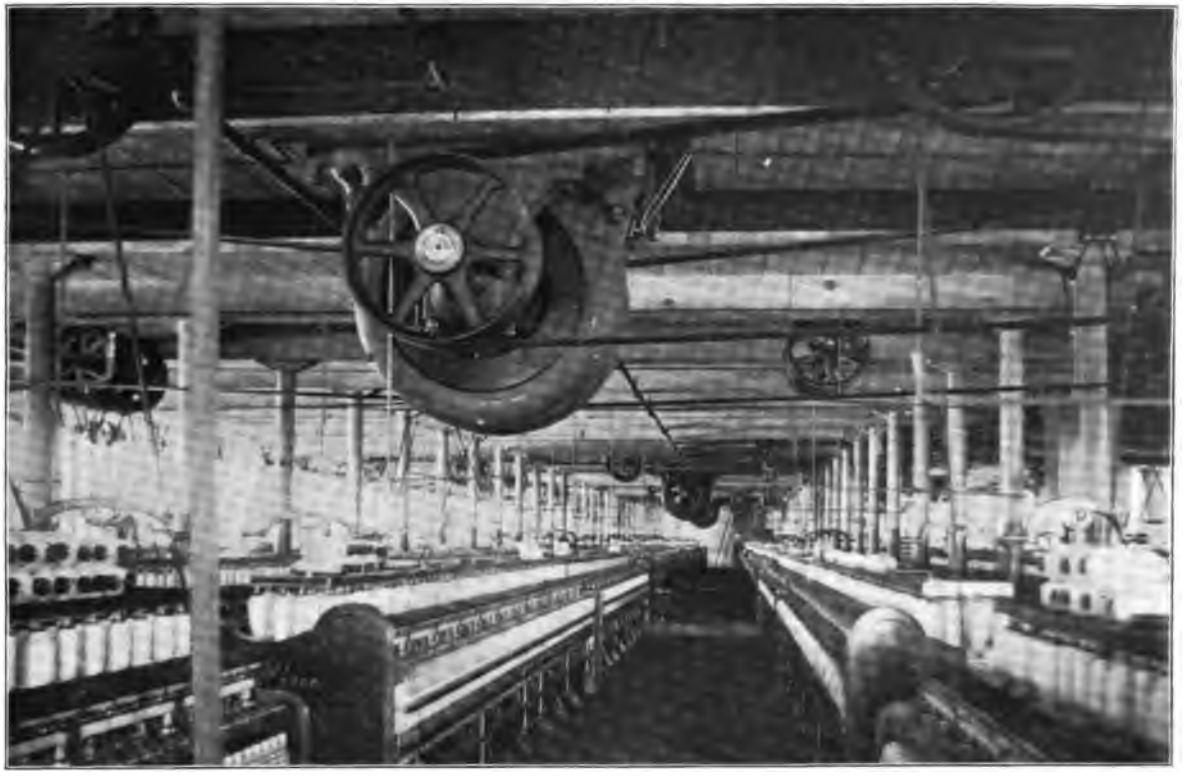
Assuming for the sake of argument, however, that the actual friction loss on a given mechanical drive is 15 per cent., and on a corresponding electrically driven plant the total losses are 20 per cent., does it necessarily follow that the latter cannot compete with the former? In this case the efficiencies would be 85 per cent. and 80 per cent. respectively. The cost of fuel and water would be directly increased by the reduction in efficiency, *assumed* for the electrical drive. Repeated tests made by different observers under varying conditions have demonstrated that the electric drive furnishes a much more uniform and steady speed than the mechanical drive, and further that the speed may be maintained at a much higher average. This necessarily results in an increase in the production. How much must this increase amount to in the supposed case to balance the *assumed* lower efficiency of the electric drive? In a cotton mill the cost of coal and water averages about 2½ per cent. to 3 per cent. of the cost of the goods manufactured. The fixed charges which would not be increased by a larger production vary from 11 per cent. to 18 per cent. of the cost of the product, depending upon the character of the goods and local conditions. Under the head of "fixed charges", I have included salaries, taxes, insurance, interest, day help (not including the spinners in the ring spinning room) repairs, teaming and supplies. I have considered that the value of these items does not depend upon production so long as all the machinery is in daily operation. Assuming 3 per cent. as the cost of the coal and water, without making any allowance for fuel used for heating and slashing, and 12½ per cent. as the ratio for fixed charges, an increase in production of 1½ per cent. would offset the *assumed* lower efficiency of the electric drive, even if the goods were sold at cost. To make this clear, assume that on the mechanically driven plant,

the *cost* of the annual production was $500,000 and of the fixed charges $62,500. (12½ per cent.) The difference between these two sums, $437,500, represents that portion of the cost which would be directly increased in the same ratio as the output. If this increase amounted to 1 per cent., the cost of the increase would be 1 per cent. of $437,500, or $4,375. *If the goods were sold at cost*, this increase would be sold at 1 per cent. of $500,000, or $5,000. The net gain would be $625. The cost of the fuel and water was assumed to be 3 per cent., or $15,000. An efficiency of 80 per cent. in place of 85 per cent. would increase this item one-sixteenth, or $937.50. It is evident, therefore, that an increased output of 1½ per cent. would offset this assumed lower efficiency. The above calculation is based upon the assumption that the goods were sold at *cost*. If sold at ten per cent. profit, the net gain would be $1,175, and it would require less than four-fifths of 1 per cent. increased output to balance the *assumed* lower efficiency. It is obvious that the higher the speed, the greater the production up to the point where imperfect work results. When this limitation is determined, that system which maintains the speed nearest to the maximum allowable, will show the largest production of perfect goods. If, therefore, the electric drive in the assumed case could maintain the average speed at a point 1½ per cent. above that resulting from the use of the mechanical drive, and still be within safe limits, it would have balanced the *assumed* lower efficiency of 5 per cent., even if the cloth were sold at cost.

It is not sufficient answer to suggest that the pulleys on the mechanical drive may be properly proportioned to balance this slip. The result would still be variable. Until the belts stretched and the speed dropped to the normal, the machinery would be running above its proper speed. If this higher speed is permissable, the electric drive would maintain it at that point and the disadvantage of the mechanical drive would still exist. Obviously the larger the number of belts omitted, the less the opportunity for slip.

To determine this question of comparative speeds, a test was made last month on a spinning frame, which had been especially prepared for the mechanical drive by proper attention to the belting and banding. On this frame, during a two weeks run, the front roll varied in speed from 118 to 113, records being taken twice a day. On this same frame, driven by a direct connected induction motor, during a similar run, immediately succeeding the mechanical test, the speed of the front roll varied from 122 to 121 on the first two days of the test, readings being taken hourly. On the third day the speed suddenly dropped to 119. An investigation showed that the generator belt was slipping. This was corrected as soon as possible, when the speed rose again to 121 and through the balance of the week varied from 120 to 122. Out of 71 readings 7 showed a speed on the front roll of 120, 38 showed a speed of 121, and 24 showed a speed of 122. At 11 A. M. on each of the last two days, the speed on all the machines in the room was observed to suddenly rise, showing that some change had occured at this hour in the speed of the prime mover, which drove the room mechanically as well as supplied power to the generator. The speed on the electrical driven frame, on each of these two readings, rose to 125. The average of the 71 readings was 121.35. The results obtained from his test demonstrated the necessity of omitting as much belting and remains of the mechanical drive as possible, if the production were to be maintained at its maxmim. The slip on one belt in this case was sufficient to reduce the speed, and therefore the production, more than 1¾ per cent. Some one may suggest that this might have been corrected as easily and quickly on a mechanical drive as it was on the electric drive. Such critics lose entirely the purpose of the test, and the lessons to be learned from its results, which were that the uniformity of the speed is increased and power is used more efficiently as belts are omitted. If we had had a generator directly connected to an engine or wheel, this slip would not have occured. It is this plan that is advised on all new installations wherever practicable.

I have heard it claimed by some manufacturers that their



SPINNING ROOM IN LANCASTER MILLS, CLINTON, MASS.,
SHOWING THREE 150 H. P. INVERTED INDUCTION MOTORS.

belts do not slip. But the beautifully polished pulleys have shown that this claim could not be sustained. Belts do slip and they are allowed to slip until it can no longer be endured and then they are taken up. During the time that they have been slipping the production has been below its proper amount and power has been lost, in direct proportion to the slip. With the motor directly connected to the frame, the speed of the latter will vary only as does that of the generator. This necessarily follows by reason of the principles embodied in the construction of the induction motor. If all the frames in the room had been driven by induction motors, the speed would have been uniform on all the frames. During the mechanical test, above referred to, the speed of the front rolls in the balance of the frames in the room varied from 103 to 121, with an average of 113.5. This variation is not unusual and is no greater than has been found in other mills similarly driven. It is the inevitable penalty paid for use of the mechanical drive. While one, or, at most, a few frames can be so nursed as to show the fairly uniform speed found on the frame during the test, above referred to, it is entirely out of the question to obtain the same results on all the frames in any large mechanically driven spinning room,

The ANDERSON COTTON MILLS of Anderson, S. C. are running 80 spinning frames, each pair of frames being driven by a motor placed between them and directly connected to each frame by a friction clutch. Between the water wheel and the frames, ten miles apart, there is not a single belt. Each frame has 208 spindles. The rings measure 1 3–4 inches and 1 7–16 inches in diameter on the warp and filling respectively. The speed of the front roll varies from 130 to 133 on the warp, and from 150 to 153 on the filling. The spindles have a speed of 9,500 on the warp and 9,000 on the filling. The average production of No. 24 filling yarn is 2.51 lbs., and of No. 22 warp yarn is 2.49 lbs. per spindle per week of 66 hours. Under date of March 28, 1899, Mr. J. A. BROCK, president and treasurer of this mill writes:

"It affords me pleasure in stating that we have found the system of electric driving installed for running the spinning frames in our No. 2 mill decidedly satisfactory. Our superintendent, who has had 25 years experience in various mills with mechanical drive, says without hesitation that electrical power is preferable to either steam or water, as it is steadier and more uniform. Consequently there is less breaking down of ends and the production is superior in quality and greater in quantity, and we have no shafting, pulleys or belting to look after."

THIRD FALLACY.

That the reliability of the electric drive has not been demonstrated sufficiently to warrant its general adoption.

In answer to this criticism, and also to substantiate my position concerning production, I beg to quote extracts from a few letters recently received from some of the prominent users of the electric drive.

The COLUMBIA MILLS COMPANY, as is well known, was the first cotton mill of large size in the world to place its sole dependence upon this system. This mill is now using over 1,400 horse power. After five years operation, Mr. C. K. OLIVER the treasurer, writes under date of March 14, 1899:

"Our opinion of the electric drive has not changed from our expression of four years ago, but on the contrary the good opinion then formed has been strengthened and we cannot more fully express to you our confidence in its reliabitity and steadiness of speed and our entire satisfaction from its use. There is no question in our mind that there is an increase in production in a mill driven by the electric system of transmission. Just what increase there is, we are unable to make a definite statement, for the reason that we have here run by no other system, but from our experience generally we can unhesitatingly say that there is a decided increase. We cannot understand on what grounds the statements are made that the electric drive is only advantageous in special cases. It is certainly another method of power transmission and in our judgment superior to others thus far in successful use, and so far as efficiency is concerned we think it is higher than that of the mechanical drive."

Speaking of the reliability of the system, Mr. OLIVER adds "We think it has been well demonstrated here."

The PELZER MANUFACTURING COMPANY is using nearly 2,600 horse power in motors. Under date of March 13, 1899, Captain SMYTH the president and treasurer, writes:

"There is beyond a doubt a great advantage in the subdivision of the drive by the use of the induction motor and the being able to run any part of the mill while the balance of the machinery stands idle. It is a very clean and regular drive and our people claim more so than either the steam power or the directly connected water power. So far as the power by electrical transmission for use in cotton mills is concerned, I consider it a success beyond question."

Mr. HERBERT LYMAN, treasurer of the HADLEY THREAD COMPANY, of Holyoke, writes under date of March 28, 1899, as follows:

"Our experience with the electric drive, put into our mills a few years ago, has been very satisfactory. It supplanted the rope drive which was not under cover and which gave me constant worry and constant expense for ropes and renewal of ropes. We find that we get more uniform power and that we save a great deal in transmission. We have seen no reason to doubt the reliability of this method of power transmission."

Under date of March 28, 1899, Mr. E. W. THOMAS, agent of the TREMONT AND SUFFOLK MILLS, writes:

"The generator which was put in here about three years ago has been run continually through the day, and for the past year every working night. During this time I can say it has been of great advantage to us, and, so far as results show, the repairs have been practically nothing. I see no reason today why it will not last for years. This generator is in use for power and in some instances the motors are quite a distance from the generator. ' For power driving, we are well pleased with it."

Mr. E. P. CHAPIN, of the WASHINGTON MILLS, writes under date of March 26, 1899:

"We have been much pleased with the alternating electric power system, having used it for some nine months, and the generator has run

23 hours per day for the major part of that time. The speed has been as even as the speed driving the generator and with no more drop than stipulated in our contract. We have had no trouble with the machine."

Mr. E. G. CHILDS, of the BOSTON DUCK COMPANY, writes under date of March 28, 1899:

"The electric power transmission plant you installed here is giving entire satisfaction and has now been in operation better than three years."

Mr. WM. D. CALDWELL, agent of the JACKSON COMPANY, writes under date of March 29, 1899:

"Since the triphase system was started up in January, 1898, it has given perfectly satisfactory results and has never got out of order so as to cause us any delay. The system has a severe test, as in our cloth room the napper and hydraulic presses are at times all working, and at times all stopped, and yet we notice no variation in speed on our measuring and folding machines, where any considerable variation of speed would be quickly detected."

Other letters might be quoted, if it were necessary, to establish the points which I have desired to make, viz.: that the electric drive furnishes a much steadier speed than is possible with the mechanical drive, and that the electric drive has demonstrated its reliability.

FOURTH FALLACY.

That the expense of the electric system is so great as to prohibit its general adoption.

In discussing this question we must admit there are some concerns which cannot afford to make changes only in the method of driving, although very beneficial results might follow. Their money had better first be spent in the purchase of new machinery. It is out of the question to formulate any positive statement which would apply in all cases. Each case has its own peculiar conditions. For instance, in a certain mill now considering this question, the annual production

amounts to $900,000. The electric drive would cost $50,000 more than a new mechanical drive. On the other hand, labor amounting to about $1,000 would be saved. Three comparatively inefficient engines would be stopped if the electric drive were used, whereas only two could be superseded by a new mechanical drive. The increased cost of operating the electric drive would be found in increased taxes, insurance and interest. These would amount to about $3,400 per year. From this must be deducted the saving in labor, $1,000, and the saving in fuel. If we ignore the latter factor, the value of which cannot be accurately determined, the net increase in cost would be $2,400, which would be offset if there were an increase in production of less than 1⅛ per cent., if the goods were sold at 10 per cent profit. It is not unreasonable to expect that there would be a much larger increase than this on account of the many belts which would be omitted.

With suitable data, it is not difficult to estimate the comparative value of the two systems in any given case. No formula, however, can be deduced which will admit of universal application.

The advantages of the subdivision of the power referred to by Captain SMYTH and Mr. THOMAS in the letters above quoted, the utilization of rooms not otherwise available for manufacturing and the ease with which power may be supplemented at any point,—all these are undoubtedly in favor of the electric drive. As it is impossible, however, to fix a definite value upon these factors, they have not been used in the above discussion. They should, nevertheless, be fully considered in deciding upon the relative merits of the two systems.

Because of its greater efficiency, of the improved quality and increased quantity of production resulting from its use, its greater flexibility arising from subdivision, and the ease with which power may be delivered at any point, the electric drive offers advantages which cannot be found in the mechanical drive.

The PRESIDENT. The subject of the paper just read is of immense importance. Perhaps no one science has ever appeared where so rapid strides and such wonderful progress have been made as in the use of electricity for its thousand and one uses. The question of its application to the driving of cotton and other machinery, it seems to me, is only a question of time. There are many advantages connected with its use such as doing away with expense which follows after steam or water has been installed, the various advantages that could be derived in the constancy of the speed and the better running of the machinery in consequence of constancy of speed; and with the close competition that we have in these modern days everything must be considered down to the lowest possible cost without regard to its first cost. I, for one, fully believe that the time is not far distant when a very large percentage of our machinery will be driven by electricity. As I said at the beginning, it is a question of very great importance. It seems to me we are all interested in it, and it is a question that is debatable. There is a great deal that may be gotton from it in inquiries and experience, and I hope that the Association will not let this pass without some discussion. There is an opportunity now, and it is desired that as many as are interested will give us their ideas in this matter.

Mr. JOHN E. PREST. I would like to ask Mr. WHALEY or Mr. PAINE whether, in case it was desired to put in 200 or 150 horse power into a room, they would prefer to put in one large motor or a series of two or three small ones.

The PRESIDENT. Will Mr. PAINE answer that question?

Mr. SIDNEY B. PAINE. This question of the subdivision of the power is one about which there is a good deal of discussion. As a rule, the more constant the load, the more uniform the load, the more steady the load, the less is subdivision desirable, for the reason that the efficiency of the plant is maintained practically constant. In a machine shop, for instance, where the

load is exceedingly variable, it is desirable to cut it up and put in small motors which will run in sections, if possible, but where everything is running all at once and all the time the large motor is as a rule desirable. This is true, I think, except in the spinning department, and it is a question there, which is now being settled by practical experience rather than by theory. We have spinning rooms running with the large motors like Mr. WHALEY'S in Columbia, S. C., which are giving excellent results. Mr. WHALEY will probably advocate the large motor. At Anderson we have tried the other scheme of subdivision because on the spinning frame we have the greatest amount of slip, probably, in any part of the mill, except in the mule room. If we can do away with that slip we will increase the production. I do not think the small motor drive is quite as efficient as the large motor drive, for the reason that it is almost impossible to make a small motor of five or six horse power have the same efficiency as the 150 horse power. Furthermore, the cost would be nearly doubled for the small motors. But the other advantages are that I would save my power on each frame as I stopped to doff and get rid of all belts entirely, and keep the production at the maximum by keeping the speed at the maximum all the time. There is a difficulty in the ring spinning room in determining the amount of power required to drive the spindles. I made one test where 512 spindles that were producing 32 yarn, running 9,200, took 5½ horse power. We made another test where, 448 spindles on 27 yarn running 8,900, took from 8½ to 10½ horse power. In another room we ran 416 spindles, 24 yarn at a speed of 9,000, and it took 6½ horse power. Now, I need not suggest to the cotton manufacturer that there is no machine on which the power may be made to vary more widely than it does on a spinning frame. You can vary your power 40 per cent. by the tension that is applied to the bands. Neither need I suggest to you practical men that the oiling of these frames has a great deal to do with it. The lining up of a long frame 19 or 20 feet long with no bracing in its construction, which will surely sag if the floor sags—all these things do change the amount of power on

a spinning frame. And that in my mind is one of the objections to the use of a small motor on a spinning frame — that it is almost impossible to determine in advance what amount of power will be required to drive that frame. I hope very shortly that a spinning frame manufacturer, whose name you would know if I should mention it, will be able to produce a frame with 450 to 500 spindles with a motor directly incorporated in its construction. The objection, of course, made to that long frame, is the doffing. You would stop too many spindles when you doff, if you doff with four in a gang. Doff with eight and you take no more time for your doffing than you do at present.

Professor CHANNING WHITAKER. I would like to inquire of Mr. PAINE how he ascertains the amount of power required to run a spinning frame; whether it is practical for the overseer of the room to determine the amount required?

Mr. SIDNEY B. PAINE. Certainly, that is one of the advantages that I discussed four years ago about the electric drive. An indicating wattmeter can be calibrated to show the output of the motor in horse power, and at any moment by pressing the button a little needle will indicate the amount of power being delivered by that motor. And if you do not care to have one of those for any particular motor or set of motors you can have that wattmeter calibrated for showing the input into the motor, and then, by a curve, with each individual motor, correct the input to show the exact output and it is absolute in its readings. It is more accurate than the Emerson scale or even the Prony brake in its indication.

Professor CHANNING WHITAKER. Do I understand that the overseer can make this determination?

Mr. SIDNEY B. PAINE. Any child can read it. All he has to do is to press a button and the instrument does the rest.

Professor CHANNING WHITAKER. Then it seems to me,

Mr. President, that this is of incalculable value to the members of this Association. There is no place in the mill where so much power is used as in the spinning room, and the great difficulty is in determining the place where the waste of power occurs. It is not a question of the design of the machine; it is a question of the care which is taken of it by the overseer and his assistants. This has all been gone over time and again before the Association. But the difficulty has been to locate the machine which is improperly belted or improperly oiled. Now if the overseer can do that, he can be held responsible for the amount of power in the spinning room with great ease, and the amount of power wasted in the spinning room.

Mr. CHARLES W. DENNETT. Mr. President, what percentage of floor space is saved in the mill that is designed for electric drive originally over the mill with the mechanical drive?

Mr. W. B. SMITH WHALEY. I would like to state, gentlemen, I have never figured it out in percentage. It was simply this, that in two mills, very similar to each other, the larger one requires a little over 1,900 horse power and the smaller mill of the two requires between 1,600 and 1,700 horse power. The mills are respectively of this size; I built both and they were built about the same time, but they were taken off practically the same plan, except one was made a little longer than the other, both being of the same width and having the same number of stones. One was a steam mill, the other designed for the use of electricity. In the larger mill which holds today about 70,000 spindles against 60,000 in the smaller mill, a difference of 10,000 spindles (there will be in the smaller mill 65,000 ultimately), the beltway was between 14 and 15 feet wide and extended within 24 feet of the front of the mill. That was a space cut out from that mill straight from the top to the bottom, at least three floors. That mill was 457 feet long and held, as I told you, about 70,000 spindles. The other mill was 371 feet long and will hold, when filled with spindles that are ordered now, about

60,000 spindles. . The small mill has no beltway at all, nothing but a fire wall going up, parting off the picker building, and that is the only space lost on the floor where the fire wall goes. There is no beltway at all. There is a saving of floor space and a saving of cost of floor space.

Mr. ARTHUR H. LOWE. I would like to ask Mr. PAINE if in building a new mill he would advocate converting all the power into electricity and then applying it by motors to the operation of machinery, or whether he would advocate a division, part of it mechanical and part of it electrical drive? Supposing, of course that this is to be a new plant, and the location of the engines and boilers may be determined satisfactorily.

Mr. SIDNEY B. PAINE. Of course in deciding that question you must assume that the location of the power house is to be equally convenient in both cases. That very rarely happens. It is generally more convenient to find the place down near the water than on an elevation, because the water is usually in a depression. But assuming that the power house can be placed in the two locations equally well, I think that the efficiency of the electric drive will be higher than that of the mechanical drive, even on the system usually adopted of driving by belt, or, as Mr. WHALEY has described, from the pulley of the engine to each floor separately. The efficiency of the electric drive will not be as high as that ordinarily claimed for the mechanical drive. The actual efficiency of the latter is, however, much less than is claimed because of the slipping which I have referred to, which is a loss and cannot be avoided. I think that the electric drive will prove more efficient. I think that the production will be larger; I am sure of that, because the tests have demonstrated that in every mill that we have driven — and there are over twenty that I have had the pleasure of trying this way — every mill, so far as I know, that has kept records and made tests, has found that the production is increased.

Now, as to the decision of driving the mill one way or the

other, I must leave that to the financier, the investor. I can advise him as to the economy, I can advise him as to the production, and in my opinion it would pay him to do it; but it is a question for him to settle, not for me. I can decide the other questions, I believe that the electrically driven mill, with the power house properly located and the mill properly located, irrespective of each other, if you wish, will prove the most economical mill and the cheapest operating mill, in so far as the cost per pound of output is concerned, everything considered.

Mr. ARTHUR H. LOWE. Mr. President, Mr. PAINE departs a little from my question, perhaps. It is not whether the mill would be entirely driven by mechanical or entirely by electrical power, but whether it would be better to convert all the power into electricity or to take part of the power in a mill mechanically and part electrically.

Mr. SIDNEY B. PAINE. I beg pardon for not having kept to the question. I see no advantage at all in trying to install both systems. On the ring spinning there can be no question, I think, that the production would be very largely increased and more than enough to offset the increased expense. I expect that fully 5 per cent. increased production will be obtained in a ring spinning room. That takes between 50 and 60 per cent. of your power, using no mules. The lighting will be done by the same generator that drives the power. That will take approximately 7 to 8 per cent. more, so that between 60 and 70 per cent. of the power can better be driven electrically without any question whatever, and I should not think it good policy to undertake to mix for the sake of the remaining 30 per cent. You have got to have your belt tower if you do mix, just the same as if you had a large drive, and I can see no advantage at all in undertaking to combine the two systems.

Mr. C. J. H. WOODBURY. The discussion has gone thus far without the use of the time-honored phrase that "electricity is in

its infancy," which is proclaimed with iteration at the announcement of every progress in the art. I was calling Mr. PAINE'S attention the other day to what was recently found in an electrical library to be the origin of this phrase of undisputed truth, which is older than the present century, as one may read on page 35 of an "Effay on Electricity Explaining the Principles of that Ufeful Science," by GEORGE ADAMS, London, fourth edition, 1792. "As electricity is in its infancy when confidered as a fcience, its definitions and axioms cannot be ftated with geometric accuracy. I shall endeavor to avoid as much as poffible the ufe of pofitive expreffion."

Mr. SIDNEY B. PAINE. Mr. President, I am sorry that Mr. THOMAS is not here. Mr. THOMAS had an interesting experience at the Tremont and Suffolk Mills. You know he had an accident to his main engine. He was under contract for a certain quantity of goods, and he took a 30 horse power motor out of the cloth room building, and put it into his weave shop, hanging it from the ceiling as Mr. WHALEY has described, and operated these looms and kept his contract, which he could not have done had he depended upon the mechanical drive alone. But that was not the part that interested me particularly. The part that interested me was that after running there three or four months, when the mechanical drive was ready to be put back into place, the overseer asked Mr. THOMAS to let that motor stay in the weave shop, saying that he was getting off more goods and better goods and that on account of the steady speed there was less loom fixing than formerly. It seems to me this is an interesting experience right in the line that Mr. LOWE has inquired about.

In regard to the advantage of driving the mill mechanically or electrically, I think that Mr. WHALEY, who is operating two mills, one driven electrically and the other driven mechanically, can give you possibly suggestions that will be of more value than I can.

Mr. ARTHUR H. LOWE. I simply emphasize my question;

it is simply whether you could not take mechanically a few of the main lines and the rest of the power electrically; whether the division of the power was wise.

Mr. LOUIS SIMPSON. We have 2,500 horse power driven electrically and are increasing our power to 6,000. I have been talking with Mr. PAINE this morning — he very kindly came to see me at the hotel — about the small motors. We have adopted the larger sections. There is one difficulty which I see in the adoption of the small motors in the spinning room. I think it is well for the members to know what that difficulty is, because they might possibly be tempted to adopt the use of small motors without looking at the case all round. It is this: small motors are very expensive, and naturally, when any one is installing small motors in a mill in which they had to install a large number of motors, they would keep the size of each motor as near load as may be possible. Now, in the event of anything happening to the mill, the floor moving out of level, the using of bad oil, or if in very heavy, muggy weather, the power taken by those frames were to be largely increased you might have your motors all burned out. That is one difficulty which I see.

I agree with Mr. PAINE in thinking that they will get more production off the frame when driven by electricity. We find that we get more production off those frames that are now driven by the big motor, and I think that by doing away with the additional belts we would get still more production. But I do not quite see how the difficulty I have indicated is to be overcome, especially in mills where they have to spin large variation in counts of yarn. You hang up your ring frame today for one count of yarn and by and by have to spin a count or quality of yarn which takes more power, and then your motor is too small for its work.

The PRESIDENT. It is the result of experience and experimenting we are getting this morning which makes this question so valuable. But very few of us have had any experience with

electrical power, and as I suggested previously, very many of us will be compelled to have experience with it. What we can get from experience, from experimental knowledge from others, it seems to me is very valuable. As was remarked in regard to the driving of the spinning frame, the fact of being able to determine the power, I think, is of vital importance. A great many of us are so unfortunate as to have overseers that do their work in the manner that will cause them the least trouble and the least labor, and they are very apt to draw their bands on very tight. They have a belt big enough, and an engine perhaps back of that, big enough to drive the frame, no matter what power it requires, and it is difficult for the manager to pass through the mill and ascertain just what power that machine is taking. But by the system that Mr. PAINE suggests, by just pressing the button, the man knows at once whether his frame is excessively banded, and so gets all the advantages and disadvantages that are occuring in the room any time he pleases. On the other hand, it is almost impracticable to do so with any other system, and it seems to me that just that one thing alone goes a long way towards commending the use of electricity.

I cannot help feeling myself, as our secretary has said — I meant to have said the word before he did, but I lost the opportunity — "Electricity in its infancy." We have indeed a great deal to learn about its application and use, and while we are getting very satisfactory results today, there is no doubt in my mind but that in the near future we shall find that we can supply electrical power for very much less cost than we can today. All new things are experimental and the most of them are improved upon. I am very much pleased indeed at the course that this subject has taken and the discussion that has taken place. Is there anything more to be said upon the subject?

Mr. FREDERICK A. FLATHER. Just before Mr. THOMAS went away he called my attention to the fact that he would have to be absent for a few minutes only, he expected, on a matter of

business, and he thought he would return in time to read a discussion which he had prepared. It is a valuable discussion and I hope it will be brought up later or be printed in the Transactions, at least.

Mr. JOHN ECCLES. Mr. President, I would like to ask Mr. PAINE if the machine referred to can be easily removed from one frame or machine in the mill to another to ascertain the amount of power that is consumed. In other words, instead of using a power scale, how much trouble would it be to take one of these meters and apply it to any machine in the mill so as to get at with accuracy the power being consumed?

Mr. SIDNEY B. PAINE. This little instrument, the wattmeter, can be used on any motor up to the limit of its capacity and any motor can be taken (by merely carrying the conducting wires from the generating machine to the motor) to any machine to which it can be attached. It would be impracticable to apply any motor to any machine in the mill by directly connecting it to the machine but to any machine as a card or a loom or your spinning frame or your pickers or any of the machines, you can belt a small motor.

I should recommend, of course, that you select a motor that is approximately the size of the machine that you want to drive, so as to have the reading on the scale as large as possible. To test your breaker pickers, I should use an eight horse power motor, because that would give you approximately where you would land. On your looms I should not use more than one horse power. I should not undertake to use the same motor. By using a proper sized motor you can belt to any machine and get an absolute indication of the power required.

Mr. JOHN ECCLES. Will you please state about what would be the cost of the apparatus to do that kind of work?

Mr. SIDNEY B. PAINE. I am sorry the question of cost has come up. I try to forget that I am a commercial man when I am addressing a convention like this.

Mr. JOHN ECCLES. I beg your pardon.

Mr. SIDNEY B. PAINE. No, I think Mr. ECCLES has a right to make the inquiry, although I try to forget entirely my connection with the commercial side of the electrical business in any discussion of papers before the Association. A one-horse power motor of the continuous current type with slow speed will cost approximately $110. Of the alternating current type it would cost approximately $140. A five-horse power motor, for alternating current, $300, and of the continuous current type, I should say approximately $200. A wattmeter might cost you $30 to $40 for an outside figure.

Mr. W. B. SMITH WHALEY. In connection with this topic, gentlemen, with regard to the indication of the machines, it brought to mind what I might mention to the Association. From the time I started our mill in Columbia I conceived an idea of keeping a continuous record of power, which I have in a power curve from the day the motor started in the mill, and it is exceedingly interesting. The instrument that Mr. PAINE speaks of, the instantaneous reading wattmeter, we have been using there now for over a year, I think nearly eighteen months, and I have a book there in which my electrician enters the record for each motor, each motor being numbered and having its own page or as many pages as it may require. We have every class of machine, the number of spindles or what the machine is, listed under the head of that motor. We have the power that it takes to drive every single machine in the mill; that is, the input of power that we measure, — not the power actually given out by the motor, but the power of the current that is fed to the motor. Some very interesting figures have been developed in connection with that work, and some figures that surprised me slightly, that is, with regard to the number of spindles I was actually running with the power consumed in the frame while spinning the yarn. It was much larger than we figured. The power is measured by a process of disintegration, you may call it. In other words, the total power that that

motor consumes is taken with all the machinery being driven under the normal conditions under which we are running the mill. Then we block off a certain number of frames, say so many spinning frames, and then we take the power that was not consumed — that is, the difference in power from the total number of frames being driven — and what power was not shown by that instrument represented the power that was previously consumed in operating those machines; and going through a process of that description we got down the power that it takes to run every single machine in that mill, and also the power that it takes to run the motor and shafting for each section. It is a very interesting work, and I am in hopes of placing some of the data before the American Society of Mechanical Engineers in the fall if I can possibly get it up in time.

With regard to the wear and tear on the machinery, it was mentioned just now in regard to Mr. THOMAS' loom. I can state this much with regard to our two mills: I had 18,000 spindles in one mill at the time these observations were made, and I had about 15,000 or 16,000 spindles in the other. In the steam mill our machine shop was doing not an unreasonable amount of work in the weave rooms, continually fixing up a loom or gear and especially gear — they would wear very heavily. As I state, the amount was not abnormal, but was a reasonable amount. In the Granby Cotton Mills — this electric mill — the working in the shop on a piece of a loom was a very rare thing, and you could observe it very reasonably and very readily by the air in going into the room. You walked into one room and you could not spot a loom whose tension was different from the others; and I have taken several of my friends into the Granby weave room and asked them to stand at several points and try to pick out a loom that was not in tune with the others. Some of them have attempted to do so, with a smile, but after trying they have been obliged to change their opinion, for they were unable to select one, the tensions were so very uniform.

Professor CHANNING WHITAKER. I had the pleasure of presenting a paper before the Association some years ago on the Emerson Power Scale, and it revealed many things, the usefulness of which would not otherwise have come to light, because it was the first machine of that sort which an engineer could use with precision. It seems to me that the spinning frame or the single machine with its own independent motor is free from the objection that it requires an engineer to run it, and an engineer to ascertain the working of that machine at the particular time. I once pointed out to the Tremont and Suffolk Mills the immense waste of power there was in the banding—I think in 1873 or 1875, perhaps earlier—and they instituted a system of determining whether their banding was all right by applying an indicator to their steam engines and judging whether their bands throughout the entire room were in order. But this did not meet the case. This method of putting the motor to the machine with its own power indicator, so that the power used can be determined on the instant, is a totally different thing and requires no engineer, no subdivision, no subtraction, no process of differentation, in order to know whether power is being wasted in a particular machine or not, and that is of great importance.

Mr. E. W. THOMAS. It is with pleasure that I can substantiate some of the statements made in Mr. PAINE'S paper, from personal experience. For several years we have had many isolated places requiring power, too remote to reach by our regular shafting, and requiring the use of small steam engines. Some three years ago we put in a 120 horse power generator, and ran wires to three storehouses, at considerable distance from each other, to drive elevators. Also, wired to our repair shop and to cloth room building, placing motors in each of the buildings referred to. We have derived the greatest economy from this installation, and, up to date, no expense. The generator has been run for the past year all night, as well as day, the night

running being for electric light service in the mills that are run all night.

In the case of a break down of a large engine, necessitating the stopping of considerable machinery for some weeks, it was desirable to run a section of over 100 looms on a special contract. A motor was put in and wired to the generator, and for a number of weeks we obtained the production from the looms, which, otherwise, would have to be driven by temporory steam engine. Not only was this advantage derived, but the steadiness in speed was very noticeable. The advantage was so great that the overseer of the room asked that this lot of looms be permanently left on the electric drive, after our repairs had been made to the engine. As motors of various sizes may be obtained, it is not a very serious matter to counteract the effects of a breakdown, the locating motor and wiring will not take as much time as placing temporary engine and piping to boilers for supply of steam. On this point alone, I consider the benefit of electric transmission of considerable value. Experiments made recently to my knowledge corroborate the statement made of a regular and uniformity of speed such as cannot and is not obtained by belting. Particularly is this unreliability of uniform speed manifest in our older and larger mills, driven by steam and water power plants.

There is no reason that, in the future, electric driven mills will not be the most in use, as they posses many economical arrangements that the mechanical does not. It seems to me that electric driving is to become the best means of operating from power plants in the future.

TOPICAL QUESTION.

114. What are the relative merits of arc and incandescent lights for weave rooms?

Mr. SIDNEY B. PAINE. I feel that this subject covers so much ground, and there are so many different questions to be considered in deciding upon the comparative merits of the arc

and incandescent lights, I could not do it justice in the short time that is ordinarily allowed. I find that different manufacturers differ widely among themselves as to the relative merits of the two systems, and the advocates of either vary in turn in their estimates as to the amount of light required on a given class of weaving. Some manufacturers will not use an arc lamp in their weave shops, while others will not use an incandescent. On account of the short space of time allowed, the discussion must of necessity be very general in its character and must be confined almost entirely to a statement of the judgment of different manufacturers in regard to the amount of illumination obtained by the two systems respectfully.

The term "arc lamp" is a very general one, and covers many types. In the "open arc" type there are the so-called 1200 and 2000 candle-power lamps operated on a constant current generator. These are of the type ordinarily used for street illumination. There are also lamps of the same candle-power adapted for operation on constant potential generators, such as are ordinarily used for incandescent lighting. Of "enclosed arcs" there are lamps of different candle-powers operated on either alternating or direct current, either at constant potential or constant current.

The term "incandescent lighting" is very broad in its scope and covers lamps of various candle-power, the number of looms per lamp and the location of the lamp with respect to the loom.

"Weaving" is also a very general term, which covers all classes of goods, white and colored, manufactured upon all widths and descriptions of looms, which may be driven from overhead or from beneath. The height of the room will have a very important bearing upon the number, kind and arrangement of lamps. All of these conditions must be taken into account in deciding on the comparative merits of the two systems of lighting. It is not merely a question as to which system or which type of lamp will give the better light. The economy of operation, the diffusion of the light and the first cost must be considered.

Until a comparatively recent time, the "open arc" was the only type in commercial use on a large scale in this country. The shadows resulting from its use, however, were very dense and the light at a particular angle very intense, thus magnifying the shadow. These lamps could be burned only about eight hours, unless a double lamp was used, and the expense of trimming was considerable. The general use of the "enclosed arc" has remedied these troubles to a very considerable extent, and I believe that the "open arc" should no longer be considered in this connection. With the "enclosed arc" of either of the types mentioned above, and especially designed for mill work, equally as good diffusion of light may be obtained in a weave shop as with the incandescent lamp, and yet the high efficiency of the arc lamp be retained. To be specific, on colored work, with the "alternating enclosed" arc lamp, I should use a lamp requiring about six amperes of current for lighting 12, or not exceeding 15, ordinary gingham looms, where those looms are belted from below. Where they are belted from above, I should use one arc lamp to 10, or not exceeding 12, such looms. The illumination obtained would be better than that obtained by one 20 candle-power lamp to each loom and the operating expense would be less. Stated another way, assuming that each gingham loom requires, on an average, about 52 square feet of floor space, with the "alternating enclosed" arc lamp I should use one lamp for about 625 to 750 feet of floor space, where the looms are belted from below. Where the looms are belted from above, I should use one such lamp for about 525 to 625 feet of floor space. With the "series enclosed constant current" arc lamp you could probably illuminate 15 per cent. more looms per lamp than with the "alternating current enclosed" arc lamp but with nearly a proportionately increased expenditure of current. Incandescent lamps, however, cannot be operated on the same generator with the "series enclosed constant current" arc lamps. This is to the disadvantage of the latter type of arc lamp, as incandescent lamps are preferable in the preparatory departments, and unless the installation is sufficiently large to

warrant different types of generators, it is better to operate both arc and incandescent lamps on the same generator. This desirable result can be obtained by the use of the "direct current constant potential enclosed" arc lamp, but these are not so economical in operation as the "alternating enclosed" arc lamps, even though transformers are used on the latter type to reduce the potential. Again, most mills are using incandescent lamps of a higher voltage than 110. In such cases, with the "constant potential direct current" arc lamp a wasteful resistance must be used to reduce the voltage.

On colored work the arc lamp has a great advantage over the incandescent, inasmuch as colors can be more readily distinguished by the former than by the latter.

It must not be forgotten that the candle-power of incandescent lamps is affected by the gradual accumulation of dust on the outside. The interior globe of the "enclosed arc" is cleaned at each trimming.

One word further about the form of generator to be adopted. It is obviously highly desirable that the same type of machine should be used for all purposes. It is also very desirable, where there are several generators, that they should all be operated in multiple; that is to say, that they all should deliver their current into a common set of wires, call bus bars, at the switchboard, thus permitting the use of the current from either generator for any purpose in any portion of the premises up to the capacity of the generator. The advent of the "enclosed alternating" arc lamp has rendered this possible, and today arc and incandescent lamps, as well as induction and synchronous motors may be operated from the same generator, or from several generators connected in multiple.

While it is true that "constant potential" generators, such as are ordinarily used for incandescent lighting, may also be operated in multiple, the types of motors which must be used on these machines are, up to the present time, less desirable for driving a textile mill. The "constant current" generators which have been most commonly used for arc lighting cannot be oper-

ated in multiple, and the type of motor which must be used therewith is impracticable for mill work.

I will not go into the discussion of the comparative merits of the two systems on other classes of weaving. I have merely suggested the above to show that the topic has many sides.

TOPICAL QUESTION.

115. How far is it practicable to substitute frames for mules in spinning filling?

Mr. ARNOLD B. SANFORD. This subject was brought to my attention by our worthy Secretary with the suggestion that I should say something upon it. I at once felt my inability to cope and handle successfully such an important question as this, and remarked to him that it was a hard topic of discussion and to arrive at a general agreement upon.

The subject is not a new one to the members of this Association, and it has been debated by many of our able manufacturers, upon the merits and demerits of ring frame filling versus mule spun filling.

It will not be my purpose to solve this problem, but merely to throw some light upon it; as there are others here a great deal more experienced upon this matter and who can handle the subject much better than I could ever possibly hope to do. Yet the subject becomes very fascinating to any manufacturer, if he will take a little time to devote to it; and in so doing he should not allow prejudice to govern his investigations. He will be amazed at the wonderful progress made during the past 15 years of substituting ring frame spinning filling in place of mule.

Rapid introduction of ring filling is due largely to the economy of frames over the mule. This has been a powerful factor in favor of ring frame, as it needs no argument to convince anyone today of the economy to be gained by equipping a mill entirely with ring frames. Furthermore, experience has shown very clearly that since twenty years ago, wonderful progress has been made in the way of improvements, by the inventors and build-

ers of machinery. Great difficulty was experienced at first in getting the yarns spun with slack twist and soft enough for practical purposes, and twenty years ago, owing to the poor quality of filling produced on ring frames, it was thought impossible, by practical manufacturers, to equip a mill to make goods without the use of mules for filling. But in leading up to where we are today, we find a wonderful change in this condition. Goods that it was thought impossible to make ten or fifteen years ago without the aid of mules for the filling, are now being produced with excellent results, and sell alongside of goods with mule fillings and command equally as good prices. We, of course, owe a great deal to our practical builders of cotton machinery of ring frames for the improvement which has taken place, and we owe it as much, and perhaps more, to one man than any other. I refer to the late GEORGE DRAPER. Through his effort, you will remember, the evener was introduced and the difficulties in the matter of adoption of the ring filling were, in a great degree, removed, and since that time, our practical machine builders have added improvements, making the ring frame spindles for filling yarns equal for many kinds of goods to the mule filling.

The chief objections have been on ring spun filling from the character of the yarn being kinky, harsh and what is called reeley, showing it in many kinds of goods in the picks, and manufacturers were unable to make as smooth and soft feeling and nice finished goods, as from the mule filling, and some able manufacturers claim today that we are unable to produce as smooth a piece of goods with the ring filling as with the mule, and I am willing to admit, in some lines of goods, this may be true.

As we investigate this subject, we are compelled to take facts and figures into consideration and we find a wonderful object lesson as we look over the mills as they are organized in manufacturing goods today. If we take the Southern States we will find that they are making goods up to No. 40s filling and produced almost entirely upon ring spindles. These goods are

being sold right alongside of the New England mills, who are equipped with ring for warp and mule filling, making the same kind of goods, and the Southern bring the same prices. For instance, let us take the State of South Carolina. We find there a total of 1,260,536 spindles with only 10,752 spindles working on mule filling, or only one per cent. In that state you will find some very large mills. Take the State of Georgia. We find a total of 779,997 spindles with a total of 46,062 mule spindles, 23,878 being in mills making goods a percentage of only three per cent. total.

In the State of North Carolina we find a total of 1,029,924 spindles, with mule spindles total 34,260, and there being only 12,260 on mule filling in weaving mills, making this about one per cent. and in this state, we have some very fine mills all on ring yarns. In New England, we find that the State of Connecticut has a total of 1,059,244 spindles in which we find in weaving mills 332,798 spindles, making a total of about 30 per cent. in favor of mules, and this state produces a fine line of goods, such as cambrics, sateens, muslins, lawns, fine shirtings and sheetings, linings, fancy woven goods, etc.

We take the state of Massachusetts and find here a total of spindles 7,907,388 with a total of mule spindles in the weaving mills of 2,465,415 or a total of 30 per cent. These we find mostly in mills making fine goods ranging from 40s to 100s yarn for filling. We also find here a notable example in this state of favoring ring filling spindles. Since the date of 1892 to 1898 inclusive, about twenty mills equipped entirely with ring spindles, have a total of 1,078,807 spindles on print cloths and goods of a kindred character. We also find another example in favor of fine goods on mule filling from the date of 1892 to 1898 inclusive, we find there has been introduced a total of 362,757 mule spindles in weaving mills to make fine goods using filling No. 60s to 150s. From this data we can draw the line as to "how far it is practicable to substitute ring frames for mules," about as follows: That new and up-to-date mills are being built to manufacture goods using filling up to 60s; fully 75 per

cent. of which are being equipped entirely with ring frames, and our Southern mills are object lessons in this direction as they are being built entirely with ring frames for making goods up to 50s yarns inclusive for filling. Now, we find for goods using fine numbers of filling, 80s and above, requiring a very smooth and soft finish goods, such as muslins, lawns, cambrics, mulls, satteens and other fine quality of dress goods, our manufacturers are equipped with mule spindles for filling, so we can safely draw the line for *fine goods* mills from 80s filling and above for mules, but for goods requiring No. 60s filling and below, the ring filling substitute mule filling for fully 75 per cent. of the goods manufactured; and we find our Southern manufacturers adopting for goods of this description entirely all ring filling. Also in the last ten years our New England manufacturers are pursuing the same courses, and the ring frame filling largely misplaces the mules up to this point, *i. e.*, goods made with No. 60s filling and below, it is only a question of time in the judgment of many manufacturers that further improvements will be made that will enable goods to be produced from finer numbers of ring frame yarns equal to the mule.

We also find that yarns are now being used extensively by knit goods manufacturers ring spun which would have been thought impossible to use ten or fifteen years ago. But for certain kinds of hosiery and underwear, the mule spun yarns are superior, and will still hold their supremacy over ring spun, and from my experience in supplying yarns to several well known, large weaving plants, who weave only, they now favor ring spun filling, who ten or fifteen years ago used only 30s, 36s, 40s and 50s.

The rapid adoption by manufacturers for the lines of goods, as noted above, speak volumes in favor of the substitution of ring spun yarns, but, of course, there are certain classes of goods in very fine numbers which will, perhaps, always require mule filling, but there are many manufacturers today, who maintain it is only a question of time when this will be overcome.

These facts and figures show to what a wonderful extent ring

frame filling has substituted mule spun filling during the past twenty years, and shows very clearly how far it is practicable to substitute the frame for the mule.

FOURTH SESSION.

THURSDAY AFTERNOON, APRIL 27, 1899.

The Association met in Chipman Hall at two o'clock, President KNIGHT in the chair.

The PRESIDENT. The gentlemen will please come to order. The question of electricity was not quite completed when we adjourned this noon, and we have not time to do it justice, perhaps, in the discussion this afternoon, but there are one or two points that touch upon those already named which Mr. EATON asked me if I would allow to be brought up. And after that, what we are proposing to do, out of respect to our members that come from the Southern states, a long distance away, who have questions here that interest us all very largely, is to begin at the other end of the program, because it is a long one, and what we have of local subjects that we cannot handle at this meeting, we can handle some time in the future and do no injustice to home members. I think it is no more than just and courteous to the Southern members that we begin at the other end of the program and discuss as many of the topics as we can.

Mr. RUSSELL W. EATON. Mr. President, I wanted to ask Mr. PAINE if he would be kind enough to answer one point that was in Mr. SHELDON'S paper, Mr. SHELDON not being here. On page 302 it is stated that all the installations that were re-

ferred to were of the two-phase system, and it is stated that a large proportion of the current is used for lighting, and that better regulation could be obtained by the two-phase system than by the three-phase system, etc. I would like to ask Mr. PAINE whether he considers it a fact that the two-phase does have that preference over the three phase?

Mr. SIDNEY B. PAINE. Mr. President, at the time the Niagara plant was installed, the two-phase system was adopted for two reasons; first, because it was claimed that there was no saving in copper obtained by the use of the three-phase system, and second, because it was claimed that there was better regulation on the two-phase system than on the three-phase. The first claim has been shown to be incorrect by the fact that as soon as the current from the two-phase generator leaves the power house, it is immediately conferred into three-phase for transmission to Buffalo, on account of the saving in copper, thus substantiating the position taken by the advocates of the three-phase system. Let me say right here, that it does not make any difference to any company whether they furnish two-phase or three-phase apparatus, so that in saying what I do I am not advocating any particular company's system. As a matter of fact, with an equally well designed generator, there should be no difference in the regulation, either on electric lighting or on motors with either the two-phase or three-phase system.

The Manchester Mills are operating nearly 7,000 incandescent lights and 200 horse power in motors on the three-phase system. This is a larger proportion of lights than is found in the mills referred to by Mr. SHELDON. Last Monday I telephoned to the Manchester Mills and ascertained that the voltage on two of the three legs of the system was the same, and the third leg was only two volts out. This was in the day time when the load would be the most unbalanced. I think that this shows conclusively that Mr. SHELDON has been misinformed concerning the better regulation of the two-phase system. This claim has been advanced by salesmen, but would not be claimed by well posted electrical engineers.

The PRESIDENT. In regard to this one question of electricity, it is so great a question that we cannot do it justice today, and in justice to other subjects that we have on our paper, I will say in behalf of the incoming Board, (whom I know will voice what I do say,) that if some of the parties interested in this electrical question will propound new questions and present new papers to be acted upon at the coming fall meeting, I am sure that the Board will give this interesting topic favorable consideration.

As before stated, I now propose to commence at the bottom of this program and work upwards, and before I say anything in regard to the round bale I want to ventilate (if I may so speak) a little of the vanity that this Association has a right to claim in the matter of that bale. I believe, if not very largely, to quite an extent, at any rate, the progress that has been made and the efforts that are now being put forth in regard to the introducing of the round bale are due to the efforts of this Association. It is one of the questions that perhaps interests the manufacturer today as much, if not more, than almost any other question we have before us. The day of large profits and extravagant waste has gone by. We have got to receive our cotton in better condition and get all the cotton that we buy with as little dirt and foreign substance in it as possible, and the methods that are adopted and are being introduced are decidedly in that line. I feel that we are going to get great benefit from it, and as I said before, I think to this Association is due much credit for the work that has already been done.

The first Topical Question this afternoon is:

116. Have the methods of sampling round bales proven satisfactory in practice?

The SECRETARY. Mr. President, Mr. JOSHUA GARSED wishes me to read this letter which he has received from a firm of cotton factors:

"In our opinion, the round bale can never be a success; certainly, not unless the ginners throughout the entire cotton belt become more honest than they are today. For instance, where

would we stand to buy 1,000 B-C by the sample taken by the ginner and put in a separate cover on the bale? Ginners throughout the country, as a rule, are irresponsible people, and if they should not represent the bale by the sample put up, what redress would we have? We would as soon have a mortgage on a flock of blackbirds as to have the guarantee of the average ginner.

"You would be surprised, now, to see the number of bales we have to reject on account of being false packed, water packed, sand packed and mixed packed. We have no doubt but what it would be a good thing for the manufacturers, as they would save the loss of heavy bagging and ties, but unless there is a better way of sampling a B-C than there is at present, there would certainly be a heavy loss made by some one in not getting the cotton they buy, or rather cotton represented by the sample drawn and put up by the ginner.

"We are not 'old fogies' in our views, and we are ready to change with the times, and when the round bale has been adopted, and the cotton in it can be thoroughly examined, we will only be too glad to handle them, if it be to the interest of the spinners we represent."

Mr. D. C. BALL. Mr. President and gentlemen: Appreciating thoroughly the fact that your time is limited, I shall be as brief as possible; in fact, shall take very few minutes. But if you allow me to take three leading points, the first is the question, "Has the round bale sampling been satisfactory?" And I thought the best way to answer that was to bring a bale of cotton here, and as far as sampling is concerned, let you see for yourselves what sampling the round bale cotton means and what anybody can do if he wishes, whether at the mill or elsewhere, or whether it should happen to be the gentleman whose letter you have heard read here. I think the demonstration of the bale itself and the sampling will be the best answer to that. In regard to the other point, Mr. President, I wish to thank you for the statement you made as regards the influence of this

Association in favor of the round bale, and it is the matter that I had in mind to mention as a just acknowledgement.

Four years ago, when the round bale system was nothing but an experiment, and myself and a few associates had taken hold of it and put out money into it to work it up from a simple experimental machine, you gentlemen held out the open hand of recognition and offered us encouragement, and I personally acknowledge the obligation which you conferred by electing me an associate member of this institution. I outlined then what was, perhaps, as the saying is, only "in the sky." Two years later I had the opportunity of addressing you here and explaining in detail the system that had been worked out of handling the round bales "from the farmer to the mill," as we say, "with one handling." At that time I asked for expressions from you, telling you plainly that while we felt that we knew the cotton business to a reasonable extent from the planting of the seed to the door of the mill, we did not know beyond that, and we simply wanted you to consider us as taking the cotton from the farmer and delivering it to you at the mill as a part of the manufacturing system of the handling of cotton. To that extent we wanted you to tell us what you wanted, tell us where we fell short of it, and give us the opportunity to give you the cotton just in the shape that would mean the most economical handling of the cotton from that point on. Gentlemen, I say for the American Cotton Company that we do most sincerely thank you, both as an Association and as individuals, and amongst them your President and a number of the others here, for having enabled us to carry out that program and having asssisted us.

Wherever any difficulty developed in connection with the cotton we were not slow to hear of it. Of course, a great many times from outside sources the difficulties were tremendously magnified. I have heard of more difficulties yesterday and today in regard to the round bale cotton than have ever existed in the bale from the very beginning, but these statements were from the outside. The fact is that you have come to us frankly and openly with suggestions as to where the bale might be im-

proved, and we have tried to meet your views. And I say again here, that if there is any point wherein the round bale of the American Cotton Company,—the cylindrical lap bale, as we call it—does not meet the expectations or requirements of the mills, or if there is any way in which that bale can be improved and its handling made more economical so that it will be more of an advantage for your mills to handle it, you have only to come to the American Cotton Company and say so, and we will, if possible, meet you on it. Our purpose is to make every step —and if you will allow me—Mr. President, to quote from your own expression of four years ago—"every step from the farmer clear through must be a step forward in manufacture; there must be nothing to be undone."

That has been the principle of the American Cotton Company — in every way to take the bale of cotton and prepare it for the mill. I do not say that we have much more than touched the surface of it. The simple matter of changing the form of the bale, doing away with bagging and ties, doing away with much of the waste and expense, is simply a part of the commercial problem of handling the cotton. But I do say that with your assistance we will be able to give you—I think it will not be very long before we do so, continuing to meet your encouragement as we have in the past,—we will be able to give you a bale of cotton that will, with the simple opening of it, be ready for your cards. There is no reason why in the South we should not take that cotton from the farmer and do just what the American Cotton Company is doing—carefully grade it in the seed, exactly as is done with wheat and every other agricultural product; grade it carefully in the seed, both as to the grade and the character of the staple; thoroughly clean that cotton in the seed, then gin it carefully—and I do not mind saying that I think there is a tremendous advance in ginning impending; we have not touched it yet; we have the commercial problems to face, and have faced them, I think, properly, but with the improvement in the ginning there will come the cleaning of the cotton right in the fluffy lint, the best place to clean it, as you

have told me and as we have found from experience; and then we will roll up the cotton into the lap ready with the simple opening of it for you to put on to your cards. I am not going to discuss the mill end of it, because you would get me pretty badly tangled up in it if I did. But if you will tell us just what you want as you test our bales of cotton and tell us where we fall short, we will try to meet you.

As for the third question, I believe that the Secretary stated that the letter which he read was from a firm of cotton factors. I was a cotton factor myself, for about twelve years, and I guess I stayed with the business about as long as it was profitable, and when I saw that the end of it was coming I pulled out of it and went into a more direct and, as has proven since, a more profitable method of handling the cotton, buying it and selling it direct to your mills. I believe the day of the cotton factor has passed — fortunately, I think, for the South. But it is perfectly natural that these people who have made their money in the cotton factorage business should oppose the round bale system. I do not think that the round bale will do away with any essential element in the handling of cotton. I think that the round bale system will absolutely do away with every unessential element in the handling of cotton and will bring you closer to the farmers by eliminating all the unnecessary expense. That, of course, is the commercial problem that we have to deal with. But incidental with that, what is of more importance to you is that we will be able to take that bale of cotton directly from the farmer, either by ourselves or through the ginners who will be handling the cylindrical lap bale, and will be able to deliver that bale of cotton to you direct, and thereby remove all these elements of uncertainty, remove the incentive for all this false packing of every character which you hear mentioned here and which you know that you suffer from; and we will establish a complete, simple, thorough system. I should not say "will establish," we *have established* it to the extent of nearly 200,000 bales this year, and I think I state entirely within bounds when I say that I think we will put up 800,000 bales next year, probably 1,000,-

000. We will be able to establish the same certainty in your buying of cotton that the miller has today in buying wheat; you will know just what you get. You will not have to pay for not only the useless bagging and ties, which are simply on the surface, but you will be able to get what you want and what you pay for. I do not think there is any question of the advantage that that will be to you. It comes back to the fact that we shall need your encouragement, and all that I would ask in that respect is that you will simply give us a fair show.

As to the question that was brought up of the irresponsibility of ginners, I decidedly resent, both for ourselves and for the ginners, any such statement as was made in that letter. That issue was brought up nearly four years ago between us and a large number of cotton buyers and factors before the railroad commission of Texas, and there, in the presence of perhaps fifty of the prominent cotton buyers and their agents in the State, I made the statement that from my own experience of a number years I would far more quickly take the sampling of a ginner than I would that of the average cotton buyer. For many years I had on an average 50 to 60 cotton buyers scattered through the South buying cotton for us. I had the usual experience. I had to keep one or two travelling auditors continually going around straightening up their accounts, charging up the balances to profit and loss. Some of the claims that no doubt you made against us in the course of time were caused by the fact that I had to take the representations, and the weights, and the samples of these cotton buyers out in the country, men that we employed at salaries varying from $40 or $60 a month up to $800 or $900 or $1,000 for the season. I had no means of knowing whether they "stood in" with the merchant or with somebody else down there; I had to take their weights, and I invoiced the cotton to you at their weights; I had to take the samples, and I invoiced it to you on their samples, and we both suffered from the consequences that must follow from such a system. And it is the system on which the great bulk of the business is handled. At the end of the year I usually ran over

my list and let go five or ten or fifteen or twenty of those men, and some other cotton man engaged them, and as he had done the same thing with his list, I gathered up his men that he had let go.

As contrasted with that, take the responsible ginner. His lease with the American Cotton Company depends on his putting up his bale of cotton properly. He has to guarantee that that bale of cotton is free from false pack of every character, free from mixing, and is of even grade and character, like the sample he has drawn. One of those samples he supplies to us, no matter to whom he sells the bale of cotton; and from experience, as well as from the plain common sense of the system, I will take that sample of the ginner every time as against that of the ordinary country cotton buyer. In fact, I had rather take that sample of the ginner than have my own man go down and draw the samples of the bale and reweigh it. The ginner has his whole reputation and his contract at stake, and a distinct liability for that specific bale which can be enforced, and you do not want any better system than that. Outside of the fact that a few ginners — I think from inexperience more than anything else — will put up a little cotton damp, and perhaps when they are first putting up their bales of cotton will put on a little too much pressure, (in spite of the as nearly automatic arrangement as we can make it,) thus producing some little hardness at the cores, which has been so magnified, causing such a terrible time over a few bales (and there is no occasion whatever for them — there ought never to be one); outside of that, in all our four years' experience, we have had no serious complaint to make of the ginners with whom we have done business. I have always had many complaints to make when I have had square bale cotton buyers, and I guess every other cotton man has, too. So that, as far as that letter is concerned, I should say that the animus of it is so evident and the plain, common sense methods of the responsibility of the ginner are so evident that I do not think it requires any further answer. If there is any question about it, however, I shall be glad to go into it more fully.

As regards the American Cotton Company, I will say that at our own foundry we are working night and day; we have already applications in hand for nearly two-thirds of the total number of presses that we shall be able to put out this season. We will have 400 presses in operation this season. The minimum production will be 800,000 and the amount will probably reach 1,000,000 bales of cotton. Thus far, between this country and abroad, we have been able to dispose each season of every bale as we put it up. We have a few thousand bales left of relatively low grades, and that is all that is left of the total four years' work. I do not know of any serious complaints, although, as I say, there have been some objections raised on account of trivial difficulty (that is entirely unnecessary) of unrolling a few bales at the centre. Whenever that occurs the American Cotton Company is perfectly ready to repay any expense or loss, and is very glad always to be informed of it, so as to overcome it. We shall be very glad indeed for any of you that have not tested it to make as thorough tests of the round bale as possible, and can assure you that any suggestions that you may make will be received in the spirit in which I am sure they will be made. We shall trust to give you just what you want in the way of a bale of cotton, and while we are in it to make money out of it, we are frank to say that there is a big enough saving in it for all of us to share. I don't know whether I talked that way two years ago, Mr. President, because I had not been getting any returns on my money and I had about all I could stand in it, but I feel all right now.

Mr. President, if you will allow me and if it is agreeable, I have a bale of cotton here and I would like to show these gentlemen how very simply and easily a bale can be sampled. Then, beyond that, the bale is at the service of the Association, and if there is any question about the bale of cotton unrolling, I shall be very glad to unroll it so that all can see what it is. If you will allow me, I will bring it here.

The PRESIDENT. Yes, sir.

[A cylindrical bale of cotton was brought forward and placed on the platform.]

The PRESIDENT. What is the weight of that bale, Mr. BALL?

Mr. D. C. BALL, Two hundred and sixty-eight pounds, as plainly marked on the bale. It is hardly fair to take up the time of the Association with any further discussion of the advantages and savings and benefits of the round bale, as I believe those are pretty well known by this time. But in the first place, as far as the sampling of the round bale is concerned, there is no occasion for resampling the bale, because the original sample is guaranteed by the ginner and goes to the buyer. But if at any time it is desired to resample the bale, if anybody wants to use the ordinary cotton auger, which is entirely unnecessary, all you have to do is to simply stick the auger into the bale and twist it around in the usual method and draw out all the sample you want of it. [Producing a cotton auger and thrusting it into the bale.] I don't know that I shall have the strength to do it myself. We ourselves never draw a sample with an auger [illustrating]; it is entirely unnecessary, as I will explain to you in a moment. The simplest way to sample it, the method which is followed abroad almost entirely, is to loosen the cover [illustrating] and simply draw the sample, just as you draw from any other bale of cotton, which is certainly as good a sample as anybody will want of the bale.

If you want to sample that cotton in the same way that the old bale is sampled—that is, by cutting it and drawing a great big sample from it—all you have to do is simply cut it and draw the sample just as you would from any other bale. [The speaker produced an ordinary pen-knife and cut the side of the cover, producing a big sample of cotton from the bale.] It leaves, as you see, the usual exposed place in a bale of cotton, affording just as good a chance for it to be damaged and just as good a chance for it to be robbed as any other bale of cotton. In other words, the plain common sense of it is that the round bale of cotton can be sampled just the same as any other cotton,

and you can take out just as much loose cotton as you want to, and waste just as much money and time over it as you can with the square bale. All I will say is that I have found from experience in raising cotton that on the average it costs us for the average number of times that bales of cotton are sampled about 30 cents a bale, three samplings, and the American Cotton Company saves that. On an average the old style of bale of cotton will lose about three pounds in the various samplings, and we save that. That is a part of the savings of the system.

After we have taken the ginner's original sample, if you want to sample the bale again at any time, you simply loosen the cover, and when the sample has been taken you stitch it up again. When I tell you that we save about 30 cents in the waste of cotton and about 30 cents in the waste of sampling, you can see where a part of the savings of the American Cotton Company come and part of the savings of the round bale are. If there is any further question, Mr. President, about sampling, I should be very glad to answer it.

The PRESIDENT. Six months ago Mr. LOVERING showed me a method of scratching across the end, that took a general sample through the bale.

Mr. D. C. BALL. That can be done just the same, sir. I brought a cotton hook in case anybody should question that. You can sample across the bale just the same as you do in the square bale of cotton, except that it is not so easy to get so much loose cotton out of it as you do out of the square bale. Of course it is unnecessary to say that you cannot false pack the bale of cotton without its showing on the end, because the cotton from two, three, four, five or six or eight gins going into the lint flue, goes round and round until it strikes the end of the flue and falls upon the condenser, and when it does that you do not know whether a fleck of cotton is going to the centre or the end, or where it is going; and it is manifestly impossible to pack this bale unless you stand right over it and pour sand into the centre of it. You have the best guarantee possible in the

fact that on the bale itself is the mark of the ginner, and it can be traced back directly to the man who made it. No two gins have the same gin mark. In addition is the label, or, as it will be this coming year, a tag within the cover which will give a full identification of the bale anywhere the world over. That mark will indicate to anyone who is at all familiar with it everything in connection with the making of the bale, so that the full responsibility — and there is the keynote of the system — the responsibility of the man who makes that bale of cotton begins as he makes it and follows clear through. That is why it is not necessary to resample and reexamine and reweigh the bale of cotton every time it changes hands, as is done with the square bale.

The PRESIDENT. If any member of the Association wishes to do so, of course he can question Mr. BALL, and he will be glad to answer any question that may be put to him.

Mr. D. C. BALL. And as I said, Mr. President, after this discussion is over, if any one wishes, we can take the bale out in the hall where we shall not interfere with the meeting, and unroll it, so that he may see for himself what it is.

Mr. LOUIS SIMPSON. Mr. President, I am very glad to find that the remarks which were made at our last meeting to Mr. WILLIAM C. LOVERING seem to have made our friends down South turn a somersault. At that meeting we were told that there was no need of sampling the bale at all; that all this could be done at the gin house. Since then our friends have taken the trouble of finding out three ways of sampling the bale. I am pleased to learn this, because I have faith myself in the round bale, but not in the way Mr. LOVERING put it before us. If we spinners were sure of being able to get the cotton we wanted, we would rather have it in the round bale than in the square bale. But I do not think myself that any of us are going to the trouble of breaking an auger by trying to get it into a bale. Either the auger is weak, or else we should have

to employ mule power, and mules are dear up in this part of the world — although we might find some on two legs if we went around the back streets. It seems to me the system by which the cotton can be traced back to the gin is a good one, and if we were sure that the samples kept at the gin fairly represented the cotton there would be no need of further sampling. I would suggest that the ginner should take not simply one sample at the end of the lap, but one at the beginning, one at the centre and one at the end, then we would have a fair chance of knowing whether that bale was going to give us the staple of cotton that we required. I think that this Association is showing its value, because our Southern friends have made a distinct advance in the last twelve months, and entirely owing to our kicking.

The PRESIDENT. I suppose Mr. BALL was simply showing us how he could do that which was unnecessary to be done. In case some of us wanted to make false moves he was endeavoring to show us how we could do it.

Mr. LOUIS SIMPSON. He tries too hard.

Mr. D. C. BALL. I might say, Mr. President, that we never use an auger ourselves in sampling the bales. In the first place, in drawing the original sample it is not drawn from the end of the bat, but it is drawn from down here near the centre of the bale while it is being made. As a matter of fact, in our double press system, as soon as the man is through putting on the cover of the bale, which is when it is somewhere about half made, his instructions are to immediately draw that sample from that bale of cotton, so that it is drawn from near the centre of the bale of cotton. When we want to redraw samples, our own plan is simply to loosen, as I did here, a few stitches and draw a fresh sample. The ginner is required to draw two samples of every bale as he makes it, and one of those comes, under a system of sealed, receipted express packages, to the American Cotton Company, no matter whether the bale of cotton is sold

to us or not. We have a thorough system by which that sealed package is receipted for as a sealed package and its integrity is guaranteed while in the possession of the American Cotton Company for one year, so that whether you buy that bale of cotton from the American Cotton Company or any other buyer, if a question comes up within one year, we stand in a position, with that sealed package, to guarantee the ginner equally with the spinner against any attempt at fraud. We stand where we can protect them on that sample.

Mr. LOUIS SIMPSON. A friend of mine close by, a professor, made the remark when he saw that auger break that our friend was in-auger-ating a new system. [Laughter.]

Mr. D. C. BALL. I think the pun is worth the effort, sir; worth the breaking of the auger. I will repeat as far as breaking the auger is concerned, that we do not use the auger in sampling.

The PRESIDENT. It is very evident that you don't use it.

Mr. D. C. BALL. I was simply trying to show that a sample could be drawn with it, but the simple and proper way is to draw it by hand without any unnecessary expense or labor.

The PRESIDENT. I wish everybody who has any interest at all in this matter would express himself. It is of considerable importance. After I have claimed the credit for what we have done about it I wish to see it come as near perfection as possible. By and by, when we say this of it, we do not want anyone else to say there is anything wrong about it. Mr. BALL says he will correct all the errors in it if we will tell him what they are.

Mr. JOHN E. PREST. What would be the extra cost of cotton put up in round bales above the cost for square bales, each containing say 500 pounds?

Mr. D. C. BALL. We aim to have you pay us as near as possible for the extra cotton that there is in the bale. I will say that in New England you have had very decidedly the advantage. The American Cotton Company's round bale cotton has been sold on an average for a quarter of a cent more a pound than the price of the square bale. I deal in both packages. I deal in the square bale quite extensively in my own business, as well as the round bale. We aim to charge a quarter of a cent more for the cotton, laying aside the fact that the 500 pounds weight of cotton in this shape will occupy only on an average about 55 per cent. the space of 500 pounds in the compressed bale in your warehouses; the fact that it is completely covered, because we do not have any open sample holes, or anything of that sort, so that there is less risk of fire, and we get a very much less rate of insurance in handling this cotton. From some of the insurance companies we get as low a rate as one-fifth of the rate prevailing on the square bale right in the same warehouse. Laying aside the saving in warehouse space, the saving in insurance, the saving directly in risk, the saving in handling (and we handle this cotton a great deal more cheaply than we were ever able to handle a square bale) and laying aside the fact that in the mill you simply roll this cotton to your picker room, you can put this cotton directly on your intermediate lapper. You can mix this cotton as accurately as you like, and, as Mr. LOVERING has stated, with four doublings instead of sixteen, and doing away with the initial machines you can make a very material saving, and at the same time get a more satisfactory lap as regards evenness and the proper mixing. Laying aside all those savings to the mill and many others that he has enumerated, we simply say to you that we want pay for the increased net cotton that you get in the bale itself. Abroad, the round bale is sold at one per cent. tare, instead of six per cent. That makes five per cent. difference, and on the present basis of the average sales abroad that means about thirty-five points (or cents per 100 pounds) that we get for it instead of twenty-five, as we ask you gentlemen. Incidentally

we get about ten points saving in the ocean freight rates abroad. The interstate commerce law is pretty strict in this country and the railroads are not allowed to make any better rates for bales where you load to full capacity of the car than where you load 12,000 or 13,000 pounds of uncompressed and 25,000 pounds compressed. But on the ocean the interstate commerce law does not hold, and we get a saving accordingly. Nevertheless we are very glad to have you take the cotton and all you will of it at the rates I have mentioned.

Mr. LOUIS SIMPSON. I would like to ask our friend if it is the intention of his company to try to bring the railway companies into line. They can pack more of those bales into a car than they can of square bales, and while I am not conversant with the law on this side, still from my general knowledge I believe that if the freight business is properly handled there can be no reason whatever why that bale should not be delivered in Canada at a less rate than the other bale. They have two rates now; they have compressed and uncompressed. There is no reason in this world, so far as I know, why they should not have a third rate for rolled. Again, as to Mr. LOVERING, I would like very much to know whether the American Cotton Company know of any mill that is using that bale and is putting it through one machine and is getting with four doublings as good a result as we are getting with the sixteen doublings? It is very easy to come and give a theory, but I would like very much to know myself whether it is actually done.

Mr. D. C. BALL. I will say, Mr. President, until it comes up to the mill door I will answer any question, but when I am among mill experts I am in much the same position I was when four years ago I attempted just the proposition of the gentleman in connection with the railroads. I argued very properly to the railroads that when they could load 40,000, 50,000, 60,000, 70,000 odd pounds in a car, as we have done with this cotton, that we ought to get a better rate.

Mr. LOUIS SIMPSON. Hear, hear!

Mr. D. C. BALL. But I found that was not the way to get at it. So it is as regards the mills; I had rather leave it to Mr. LOVERING, who may be in the room, to answer that question as to the mill. I have myself been in his mill at Taunton, and I have with me a photograph of the bales unrolling on the machine, and I know that from that one machine they are formed direct into the lap and receive one doubling thereafter, and we have his published statements—in fact, I have a large number of copies of his statement here with me—that he has gotten more satisfactory results from that than he did under the old method. I will say in passing that at that time I figured with the foreman of the mill that it took four bales one hour and forty minutes, which I think was as fast as the beater could work them up, and they figured that one man could attend to six of those machines. That would be twenty-four of these half bales, (which were made this size in accordance with the request of a number of mills), which could be worked up in one hour and forty minutes with one man, and that meant the only man that was needed in the opener room. The bales were simply brought to him, and he could put them on the machine and handle them.

Mr. ROBERT MCARTHUR. Do you claim that the layers of cotton in the bale are of uniform thickness?

Mr. D. C. BALL. I will not say that they are as uniform as they will be after they come from your finisher lappers, but they are as uniform as they can be outside of the delicate machinery that you have at the mills. The statement as published by Mr. LOVERING is that the picker lap made from four doublings of this bale is more uniform than the picker lap that he used to get from sixteen doublings in the old way. As I say, I do not pose as an expert in handling cotton machinery, so I am a little careful.

Mr. EDWARD ATKINSON. Does the interstate commerce law

forbid making a discriminating rate on this cotton as compared with the ordinary bale? I thought that difficulty had only occurred in Texas, owing to a local act.

Mr. D. C. BALL. I will answer you in this way: the saving in freight rates for the immediate present is really a commercial problem only, that the American Cotton Company has to face. We have not found that it was good policy to undertake any radical measure that involved the opposition of the railroads. I believe you will recognize the fact that the railroad rates are based primarily upon the loading capacity of the cars; secondly, upon the risk assumed by the railroads in connection with the commodity. Of course the value of the commodity as well as the danger of destruction or breakage makes the element of risk. There are a great many more prominent railroad people of the country that are strong friends of the round bale, and I believe that the time is not far distant when the round bale will receive proper recognition. Just at present, Mr. ATKINSON, I will say that the American Cotton Company has to simply do like anybody else with a commodity of that sort: it has to see that it goes by the route of least resistance, as the saying is. That is about as close as I can come to the situation without getting myself into trouble.

The PRESIDENT. I suppose in reality the law of supply and demand will eventually apply to this as well as to all other commodities. The Association, perhaps, or some of the members will remember that some three years since I presented a brief paper to the Association on this very question, taking up at that time the question of freight. It was shown that we could send nearly twice as many pounds of cotton in a car put up in this way as we could put up in the original form, and it was also demonstrated that if there was nothing except the deadwood — that is, the empty cars that had to be returned — it was a vast saving to the railroad company, because the same amount of cotton brought to market required only half as many cars, and that was demonstrated from the fact that the ordinary bale does

not load a car; it fills a car, but it does not load it to its carrying capacity, and we can put in about double the number of round bales and not overload the car. Then a very large part of the cars that bring our cotton here go back empty, so that the railroad companies would at least save the hauling of one-half of the deadwood if they brought twice as many round bales in a car of this as they do of the square. So that in the long run — perhaps for the time being — the railroad company is getting the benefit of it, but Yankee blood does not submit to that forever, and the law of supply and demand, as I said, regulates this, and if there are not railroads enough to do this business now — and it is paying enormous profits if it is brought in this form — if the other method was merely a living business, this is an enormous business — so that if the railroads did not haul it at a living price, capital would bring more railroads. If you put it in the proper form the rest of the problem will take care of itself. Such is my opinion in regard to it.

Mr. LOUIS SIMPSON. Perhaps the railroads should be united.

Mr. ARTHUR H. LOWE. Mr. President, since our last meeting I have seen one of these new baling and ginning mills complete, and I wish I could picture to you men who are practical in handling cotton what I saw. The seed cotton is taken from wagons or bins and is drawn through an air tube into a distributor, passes along by the gins, comes out from the gin in lint, the seed falling below; it is taken into another trunk and brought into a large receiver. Perhaps you have all seen cuts of it. But to see it is to realize how mechanically and how perfectly it is handled, how impossible it is to water-pack or mud-pack or false-pack this lap bale. After the cotton comes into the receiver it runs down into the lap and is rolled up into this bale, and the bale is rolled off and wrapped up as you see it there. The whole thing is perfectly clean. The storehouse where I saw considerable of it packed was as clean as a storehouse where carpets are stored. There was no lint lying around, whereas in the other department of the storehouse where there was the old-fashioned

bale, you know what the condition was. And then it is ready for shipment without compressing. Our President and some other gentlemen stood with me one day before one of the old compresses. The cotton had gone through the country press and been brought to the compress. The cotton was run out onto the platform to stand there in the weather until its turn should come to be compressed. While we stood there some was run in; the burlap was all cut to pieces, thrown under the compress, and there, standing in front of the compress, was a darkey taking waste and great pieces of burlap and throwing onto this bale. Somebody had to pay for that old burlap and waste of course, and it was paid for by the mill that bought the cotton. I never realized, not having received and used the cotton in the bale, as we do no spinning at our mill, anything of this false packing, until I stood with our President before this compress and saw this thing done. In one case the storehouse was perfectly clean; the cotton looked like merchandise. In the other case it looked like waste. It seems to me that if through the instrumentality of this Association we have brought the baling of cotton up from that condition to the present where it only seems necessary for us to discuss the method of sampling, we have certainly made some progress, and I believe that it is going to result in a great saving to the industry, a great benefit and profit to the mills. Matters of transportation, as has been suggested by the President, will be governed by the condition in which the railroads find themselves after they come to handle the new bale in large quantities.

Mr. EDWARD ATKINSON. Mr. President, we measure distance by cost, and if the effort of the railroad is to keep the New England cotton mills twice as far from the cotton field as they need be, it would be an important point for this Association to be aware of and take hold of. I have always looked upon the interstate commerce law as one of the obstructions to the expansion of the railway service, but I did not think it had gone so far as that, or that outside of Texas any interference had

been made with the rate of freight. In Texas we know perfectly well that the combination of compress men, factors and others has made the effort to keep improvement out of Texas. They will soon get over this blunder. It is another of their methods of keeping capital and credit out of Texas.

Mr. D. C. BALL. Mr. President, if you will allow me to say this, I believe that the round bale will receive the proper recognition from the railroads and almost if not quite proportionately to what it saves, and I do not believe we shall have to go to any very severe measures. We are doing a great deal, a vast deal, in fact, of hard work with the railroads in that line. Perhaps the time of some of us is taken up almost as much, I may say, in connection with railroad matters as it is in connection with some of the other more important operations of the business. I believe, Mr. President, that the round bale will receive proportional recognition from the railroads without our arousing any serious spirit of antagonism. The railroads themselves, of course, are very jealous of the question of reducing their freight rates. The fear that reducing of the rates on the round bale would affect their rates on the other bales of cotton has made them very slow to act. They are holding many meetings and we are attending those meetings and discussing the matter very thoroughly with the railroad people, and I believe, gentlemen, that you can pretty safely count upon it that by the time you will have thrown aside many of the machines that we think will be useless in the mills, and adopted the round bale system more, largely, you will find that the railroads will have met the situation and have made rates that will make it still more to your advantage to use the cotton.

The PRESIDENT. Mr. LOVERING has just come into the hall, if he has any remarks to make, we shall be glad to hear them.

Mr. WILLIAM C. LOVERING. Mr. President, I occupied so much of the time of the meeting in the autumn at Crawford's

that I hardly feel authorized to take any of the time of the Association today.

The PRESIDENT. Let me state, Mr. LOVERING, what I presume you already know, for fear it might be misinterpreted, that the question was on the sampling of the bale.

Mr. WILLIAM C. LOVERING. I was going to address myself to that phase of the question. I understand that the question of sampling the round bale had been exercising the minds of some of our manufacturers. I do not know what Mr. BALL may have said to you, but at the risk of repeating what he has said I will go on and say that the method of making this bale is such that it is impossible, absolutely, to get any cotton into the bale which shall not be exhibited on the end of the bale. You will understand that this bale is made by driving cotton through a dirt trunk up to a condensing cylinder. Now you know perfectly well that it is impossible to run one kind of cotton on one edge or one kind of cotton on the other edge, or another kind in the middle; that whatever goes into that trunk is fairly represented across the whole width of the trunk, and whatever is represented in the width of that trunk is represented on the end of that bale. When it comes to sampling, in the first place, samples of this size (exhibiting sample) are afforded to every person who sells the cotton, and all you have to do is to verify those samples. That is easily done by taking out with the hand or even with a common cotton hook, cotton from the bale. I have also quite an ingenious little sampler, which you can screw into the bale if you choose. [Exhibiting an instrument resembling a corkscrew, with teeth cut on the edge of the screw. Laughter.]

The PRESIDENT. You had better be careful of that; we have had a little experience.

Mr. WILLIAM C. LOVERING. It is used for nothing stronger than cotton. You can draw out some little samples with it.

That is simply a corkscrew with the barbs acting as you screw out. I will pass it around in order that you may see it. It is rather an ingenious little contrivance. I only do that to show that there are many ways of arriving at the cotton that is in the bale.

The PRESIDENT. It is a very happy suggestion if this matter can be regulated by the use of corkscrews.

Mr. WILLIAM C. LOVERING. [Taking a sample from the bale through the cut in the side of the cover.] This is the old-fashioned way of sampling cotton, and I think you get just as good a sample out of that as you do out of the ordinary square bale—just as good, and no better. It does not amount to a row of pins, in my judgment, as good sampling of the bale. But picking it off as you can with your own fingers right from the end, you can verify any sample by which the cotton is sold. I am still a great believer in the round lap bale, for that is what we call this bale. I do not want to take up any more of your time, but will be more than glad to answer any questions that can be asked about it. I presume Mr. BALL had told you the whole story.

The PRESIDENT. For the benefit of the Association I will repeat a question that has already been asked: that was, in regard to the running of the cotton direct from the bale upon the intermediate lapper. It was suggested that you had had some experience in that direction.

Mr. WILLIAM C. LOVERING. I have repeatedly done that, and very successfully. But the best system that I have adopted was the one running four bales upon one apron and driving that through a dust trunk onto the intermediate lapper, or you make a finisher lap right then and there if you wish. By that means you get a most admirable mixing. As I described to you last autumn, the ordinary way of mixing cotton is perfectly unscientific and unsatisfactory. Where you undo a dozen bales of cotton and throw the cotton up higglety-pigglety into a bin, and then

expect to have a fair mixing and a fair airing, you cannot do it. But in this way I can take 64 bales, and I will get an equal quantity of each bale in every lap, and the best place in the world to air cotton, if I understand aright, is right in the lap itself after it has been through a beater. I do not believe cotton can be properly aired until it has been through at least one beater and the air beaten into it. I have had the very best results both in airing the cotton and in mixing the cotton, treating it in that way.

Mr. LOUIS SIMPSON. Do I understand that the gentleman said that he got an average of 64 bales?

Mr. WILLIAM C. LOVERING. An equal quantity of 64 bales,

Mr. LOUIS SIMPSON. With a doubling of four only.

Mr. WILLIAM C. LOVERING. No. I take my four bales and I run them through and make a set of laps, and then I put those by, back against the wall; I take four more bales and put those through; I take four more bales and put those through, and then another four; and then I have four rows. Then I take those four rows and I put those on to an intermediate lapper, and having treated another set with another machine and done that over four times, I have sixteen sets. and four times sixteen, or 64 bales.

Mr. LOUIS SIMPSON. Thank you, but we were told that you had dispensed with all the machinery in the picker room except one machine.

Mr. WILLIAM C. LOVERING. That is just as you choose. On coarse numbers it is perfectly possible to do that. I have succeeded in making good strong yarns, really stronger yarns, with only one operation; putting it on to the intermediate picker I have succeeded in making stronger yarns than any other way.

Mr. ROBERT MCARTHUR. How do you account for its being stronger?

Mr. WILLIAM C. LOVERING. Only that there is not excessive picking; the cotton is not injured. As Mr. ATKINSON will tell you, the more you handle the cotton the more you break the fibre.

Mr. EDWARD ATKINSON. I have got to take part of that back. [Laughter.] When you — as I hope you will presently — get to our subject, we will show you how some of my theories have been modified — the first, I believe, I have ever had to take back. I am very glad to have a practical man like Mr. LOVERING confirm the theory which I presented to Mr. BALL four years ago, that the function of the American Cotton Company was to send a breaker picker lap to the mill. The breaker picker lap is now coming to the mill. A great many men beside myself have reasoned that great injury might be done by the beating of the picker blades against the cotton in that condition. But with this machine which Prof. CHARLES L. NORTON has invented it is proved that the maximum of injury by the application of mechanism to the cotton fibre is done by the saw gin, and that when you put that cotton into the picker, there is probably such an air pressure in front of every picker blade that the metal never touches the cotton. We find to our surprise that there is not that injury to the ultimate fibre or to each particular fibre of the cotton that we had anticipated. There is a little, but not very much, and it is no longer, in my mind, as much of an object to get rid of beaters in the picker as it had been before this invention which will presently be shown you, but we must get rid of rotating picker blades for other reasons.

The PRESIDENT. Is there anything further to be said in regard to the sampling of this bale?

Mr. WILLIAM C. LOVERING. I would like to have my corkscrew returned.

Mr. EDWARD ATKINSON. It is safe; it is not good to draw a cork with.

The PRESIDENT. The next paper will be "The Fibre of Cotton" by Mr. EDWARD ATKINSON.

Mr. EDWARD ATKINSON. Mr. President, I believe that calls me.

The PRESIDENT. Yes, we are glad to.

Mr. EDWARD ATKINSON. I am going to adopt what I think would be an excellent plan for this Association to adopt — to pass very hastily over what is printed and which can be comprehended a great deal better by reading than by listening. I think it would be further a very great change for the better in this Association if printed statements which are to be submitted could possibly be called for in such time that they could be distributed before the meeting and read before the meeting, to the end that we might not listen to the reading of long papers, but might discuss the salient points when we come here.

Mr. LOUIS SIMPSON. Hear, hear!

Mr. EDWARD ATKINSON. Therefore, I am not going to read this paper. You will all read it, I am sure. I am pleased to say that the round bale, in one form or the other, and possibly the Dederick square bale, are all leading in the same direction — to bringing the cotton from the field to the factory in a suitable condition. And I am only going to submit to you one other theory that I want you to take up. The effect of the saw gin is to take the fibre from the seed and fill it with air, which is never pressed out. When the great compress comes down it presses the air in the bale, then the bale reacts, and it is constantly tending to burst the bands.

I have lately made a suggestion to the managers of the present gin stands, especially in Texas where it is proposed to make a standard bale of uniform size, to put pressure rolls between the saw-gin and the press, taking the cotton as it comes from the saw-gin filled with entrapped air, squeezing the air out and perhaps making a bat which can be laid in regular forms in the

ordinary bale. Would not that tend to overcome many of the evils of the present method of compressing? Not of course making a bale that would long compete with the better and safer bales now being sent to market, but diminishing for a time even the fire hazard and the waste of the present bad methods.

I now call your attention to my main point. When the cotton is taken from the seed by the roller gin it is drawn off substantially in parallel lines; it is drawn upon the bale, either in the American bale or in the Lowry bale or perhaps in the Dederick bale, on substantially the parallel lines that the roller gin places it in. When you bring it to the mill and put it through a picker and a card you again tangle it all up and snarl it, and then you have to have ever so many processes of drawing in order to undo the tangling and get it parallel. But you have in your mill the comber which keeps the parallel as compared to the card, and if you get roller ginning into use and round baling into use and bring the cotton to the mill in substantially parallel lines, all you have to do to maintain those parallels through the comber and into the cloth is to invent a machine in place of a rotating picker blade that will take out what little waste is left by the American Cotton Company—invent a machine that will do the work of a finisher lapper without tangling up the cotton. Can you carry that cotton on parallel lines through the process for which you now need rotary picker blades? I think I am right. You can have parallel lines from the field through the bale up to the mill, into the opening room, of the crude cotton. You have parallel lines through the comber, through the drawing and the spinning. The only tangle you have now left to get rid of is in the rotary section of your picker. That ought to be invented out of existence as much as the saw gin ought to be invented out of existence. That is all I have to say that I want to bring before you verbally on this topic.

I want to add a word. I regret that this meeting had not been held in the old Institute of Technology. Many of these things could be better illustrated by the lantern, and it seems to me that that is the natural home of the Association. Since the

subway was opened the objection of distance is removed. I hope before the next meeting is held when you will have further subjects of this kind to consider, for which you ought to have the lantern, that the return to the Institute may be considered by the Board of Government.

I give way now to Prof. CHARLES L. NORTON, who will exhibit to you his machine. I have stated in my paper that when I saw the opportunity that was given for investigating this matter, I said "This ought to be done." I put in a little money of my own, got some from EBEN DRAPER and three or four others, got some cotton from the Advance Gin and Mill Company, put the thing into shape and paid for the machine, and I knew somebody would see its value. I am about $75 in advance now and Mr. NORTON is building a steel machine instead of a brass one. I do not like to go around and ask my friends for money — I think this is for the general benefit; it is no particular benefit to me. I hope that after you have seen Mr. NORTON'S machine and heard from it that this Association may find it expedient to make an appropriation which will enable the work to be completed. I will spare you the reading and give place to Mr. NORTON.

THE FIBRE OF COTTON.

EDWARD ATKINSON, Boston, Mass.

Away back in the 70's I brought before this Association the first micro-photographs of the cotton fibre and of other fibres that had ever been taken in this country. They were prepared by Mr. CARL MEINERTH, an amateur photographer of Newburyport. I doubt if any similar photographs had been taken in Europe before that date, all previous pictures of the cotton fibre having been drawn.

I then reasoned that the treatment of the cotton fibre from the field to the cloth should be governed by its form and structure. I very soon condemned the saw gin as a machine which ought to be invented out of existence. Since then I have followed up every germ of promise in every roller gin presented, in the hope that the only disadvantage of the roller gin, namely, the small product, might be remedied.

At a later date, I think in 1883, I became acquainted with Dr. F. H. BOWMAN. Upon his dictum, not found in his book, but stated to me verbally, that we could find in the finished cloth only about 25 per cent. of the initial strength of the normal fibre of cotton,— since increased in his judgment in a letter to me to a possible 35 or 40 per cent.— I began to reason and perhaps followed a wrong line. I sought for injury to each specific fibre in the several processes to which the cotton fibres are subjected, imputing the greatest injury to the saw gin, next to the rapidly revolving blades of the picker. Subsequently I reasoned that we might find great injury in the lickers-in of carding engines,— not very much in the carding engine itself,—

greater injury in the drawing of the sliver under heavily weighted rolls. It was not then possible even to attempt to find out at what point or points this impairment occurred. Professor ORDWAY invented an ingenious process for testing the breaking strain of normal fibres, proving that a true fibre of bottom land cotton was equal in strength to a fibre of wrought iron of the same size and form.

It has always been my desire to test this question. The establishment of the Lowell Textile School offered the opportunity to put small lots of cotton through all the processes on machinery previously cleaned of other lots. When I witnessed this opportunity I made up my mind that this work should be done, but the right man to do it had not then appeared, Professor ORDWAY being far away. I had, however, become impressed with Mr. CHARLES L. NORTON'S power of observation and inventive capacity, of which you all have evidence in his report on Boiler and Steam Pipe Coverings, on the Diffusion of Light by Ribbed Glass, and other matters. I therefore stated the terms of the problem to him. He had never given any special attention to the cotton fibre and knew little or nothing about its treatment in the factory. He, however, became very much interested, and I think I may say that this problem has taken possession of him rather than he of it, and I have had to caution him against overwork and over-use of his eyes in the fine processes.

Ere long he invented a unique machine which will presently be put before you, and this machine he was obliged to make with his own hands, being unable to get the different parts from any of the fine tool makers.

The result I cannot call a disappointment, yet it is not wholly consistent with the hypothesis that I had grounded on Dr. BOWMAN'S dictum. If it is true that in the average yarn we only find a breaking strain of 25 per cent. of the sum of the breaking strains of the fibres of which that yarn is made up, we may hereafter attribute only a part of that apparent loss to any injury to the cotton fibre itself in the processes of treating it. We must attribute the rest of the apparent loss to the fact

that we cannot bring a uniform tension upon all the fibres that make up the substance of any given thread, therefore we break them one by one. If they could be cemented or so laid parallel to each other that the strain upon all the fibres would be uniform, then we might have a correct measure of the injury to each fibre in the several processes of treatment. We can, however, only approximate a laying of the fibres parallel to each other but can never attain a perfectly uniform tension upon all at once.

These tests, however, have confirmed the main hypothesis. The effect of the saw gin is as bad as my theoretic imagination made it out. It does impair the strength and injure the lustre of nearly every fibre which is subjected to it. This will be made plain to you in the evidence which Mr. NORTON will presently submit. The picker blades do some injury, but not nearly as much as has been imputed to them. Neither the carding, the drawing nor the twisting machines seem to work any considerable harm to the specific fibres in any of the samples which have been tested. The list and record of these samples will be submitted, but as yet what we have done is merely preliminary. I have never believed that any compressron to which cotton in the bale can be exposed would have any effect on the single fibres, but I have supposed that compression under metallic surfaces on rolls of any kind when the sliver is in process of extension must injure the fibres. This now appears to be doubtful.

I think you will find that while we may not have opened the way to improvements on the line which myself and several gentlemen of more practical skill in cotton spinning had expected, we have yet given a direction to the improvement of cotton which must be followed. It is now a well established fact that by substituting the comber for the card we get stronger and finer yarns from the same cotton than we get when it is carded. Yes, it will be said, we comb out short fibres, leaving only fibres of uniform length. That is true, but we also lay these long fibres on parallel lines in a degree which cannot be attained on any carding engine and that is the point to which I would now call

your attention. I think I have referred in a rough and ready way to this subject at previous meetings.

The advantage of the roller gin not only consists in avoiding the injury of the saw teeth, but the roller gin draws the fibres from the cotton seed in parallel directions. These fibres can be carried on the same parallel lines into the cylinder bale either in the lap of the American Cotton Co. or the coil of the Lowry press, but when these fibres lying in parallel lines are subjected to the rotary motion of pickers and of cards they are upset, disarranged and tangled in every direction. Then we proceed by numerous processes of drawing to bring them back again to substantially parallel lines before we put in the twist. The substitution of the comber for the carding engine does away with one of these tangling machines. There remains but one other, the picker or opener.

Herein is presented a new problem. How can we get picker waste out of raw cotton without putting it through an opener or picker such as we now use? Is it not as necessary to the true treatment of the cotton fibre to invent the present processes of opening and picking out of existence as it has become necessary to invent the saw gin out of existence? If we can do this then there will be a very great improvement in carrying the cotton from the field to the cloth on parallel lines.

As I understand the plans of the American Cotton Co., they have adopted all the suggestions which I made to the original promoters of the press now made by them, when it was first presented. You may remember that the first bale publicly submitted here from the Bessonette press was unrolled in our office. I had examined all the patents and I told the promoters that their bale was in bad form; that their proposal to put an iron core into the middle and send it to market was absurd; that their press contained 100 or more parts when 25 ought to serve the purpose; and that it contained only the germ of a very great improvement; "But," I remarked, "you are only making a picker lap under condensing rolls, and I want to kick myself for not having thought of this long ago." Such is the force of

habit. We had all become habituated to rectangular bales of cotton of a bad and bulgy kind, in which the saw gin puts an enormous amount of entrapped air which is compressed with the cotton, making a dangerous bale always liable to burst its bands. Why was it left to a Texas man to conceive that cotton could be so packed in a cylinder so free of entrapped air as to take up less room and be in better condition than in any square bale ever dreamed of? Also a bale that cannot be easily burned which I then named The Underwriter Bale. It is yet possible the DEDERICK square bale may be made of equal merit provided the air is squeezed out before the cotton goes to the press.

About four years ago I made the suggestion to Mr. D. C. BALL to send picker laps instead of bales of cotton to all the mills. He has made a memorandum for me to this effect as follows:

"You stated that the true place in which to clean the cotton and prepare it was at the ginnery and that in your opinion the most important work our company could undertake and one that you were confident that we would quickly see to, would be in that line. You entered at the time into some discussion of the use of whippers upon the seed cotton and upon the lint cotton while in a loose state. Finally you stated that you were confident that with cleaning the seed cotton with more careful ginning and with the use of whippers on the light, flaky, freshly ginned cotton we would be able to deliver to the mills in our cylinder bales what would be practically picker laps, requiring at most only lap machine of one beater at the mills."

This is what the American Cotton Co. now intends to do.

This opens two or three questions. Until some one finds out a way to remove the waste now removed by the opener and picker; or such of it as is left in the American Cotton Co's bale, without applying rotary machinery to the fibre and thus upsetting and tangling it, we may expect to receive breaker picker laps from the American Cotton Co. which can be put up to a single beater and thereon converted to finisher laps ready for

the card. A mixing can be made of many bales into one. But if this plan is adopted the cotton will have no time to season or air slack unless the finisher lap will suffice for that purpose. This may serve if finisher laps are stacked away for a week or so. We may hope for much less waste subject to removal before the carding of the American Cotton Co. works on their proposed lines.

I understand the purpose of the American Cotton Co. to be to grade the cotton in the seed, separating upland from bottom-land; or, in Texas, prairie cotton from bottom-land cottom; next to dust it in the seed, and then to mix or keep separate according to conditions in the ginning. If these plans can be carried out one may expect much evener conditions in each grade of cotton sent to market under the guarantee of this company. If the process of mixing and preparing, up to the breaker picker lap can be done in the South at low cost, then so much less work will be required to be done in the northern factories even if we must still put it through a finisher picker. Or, to put it in another way, if the present bad work in the cotton ginneries of the South is well and righly done, there will be much less bad work to undo after the bale of cotton reaches the mill.

I therefore present to you as inventors the problem of inventing the present rotary beaters of the opener and picker out of existence, to the end that the tendency to lay the cotton in substantially parallel lines may be continued from the seed, through the roller gin, through the cylinder bale, through the substitute for the picker, up to the comber, and thus on to the finished cloth. In that way you may realize a very much larger per cent. of the initial strength of each fibre when the fibres are converted into the yarn and into the cloth.

Being well assured that the results which would be developed in this investigation would be of sufficient value to warrant the recovery of the money advanced by myself, I have subscribed a small sum as my own contribution. In addition to that I have received from others $175, which has been appropriated. I am now in advance for the construction of the machine, the purchase

of cotton bales and other matters about $100. As yet Mr. NORTON has done this work from pure interest in science without any compensation for his time and service. Whether it will be judicious for him to patent his apparatus or not is under consideration. I think not.

I have asked Messrs. A. M. GOODALE and HERBERT LYMAN to act with me as a committee on this matter, and they may state their conclusions.

All that we have done is mere preliminary work. Many tests will suggest themselves to you, such as the effect of mercerizing, the effect of hot drying as compared to cold drying, the effect of different methods of bleaching, the effect of the metallic roll as compared to the covered roll, etc. Six months' work with experts employed will be none too long to make the scientific applications of this apparatus, determining purely scientific points from which practical results may afterward be developed.

I think it would be judicious for the Association to make an appropriation for this purpose to be expended under the committee already in existence, or under the supervision of others, or adding others to that committee.

You will understand that I have never suggested this method of examining the cotton fibre and do not now suggest it with any idea that it can be applied in the purchase of cotton. It is purely scientific work which may or may not result in practical improvements. It is a kind of work that must be done wholly outside the factories in the textile schools and in the physical laboratory. I may say, however, that I have been in correspondence of late with the chiefs of experiment stations in the cotton states, especially in Texas and Louisiana, on the improvement of the cotton plant and its cultivation; the development of a larger quantity per acre of better staple by intensive cultivation and by the selection of seed. Very great progress has been made, especially in the development of long stapled cotton which may take the place or even be better for many purposes than Egyption cotton, but up to this date all that cotton has been mangled in the saw gin.

I may also add that Dr. STUBBS of the Louisiana Experiment Station, one of the ablest men engaged in that work, is eager for this machine, deeming it a bit of essential apparatus for the study of the improvement of the cotton fibre upon the field and from the field to the bale.

I regret that this meeting had not been held at the Massachusetts Institute of Technology where Mr. E. W. ATKINSON'S illustrations of the Southern ginning establishments could have been exhibited with the lantern, and the papers of Mr. NORTON and myself might have been made more interesting and clearer with a lantern. I doubt not that the government of the Institute would be glad to put Huntington Hall which seats twelve hundred, at the disposal of the Association and now that the subway is opened these buildings are no longer at an inconvenient distance. I think that the Institute is the natural home of such an Association as this, so many of its graduates being in important positions connected with the cotton industry, and I suggest that a vote of the Association itself might now be taken in order to determine which would be the choice of the members, admitting the greater proximity of this building to the business part of the city. I imagine that we shall have a good deal more work to present to the Association at a future date in the analysis of the cotton fibre which will absolutely require the use of a lantern to make the subject as plain and clear as it should be made.

DISCUSSION.

Prof. CHARLES L. NORTON (By Invitation of the Board of Government).

I fear that in bringing anything relating to cotton before your Association, one who knows as little about cotton as I do is liable to be threshing over old straw. Moreover, the good opinion which Mr. ATKINSON has expressed of my recent efforts may have led you to expect more than I can give. But I trust you will find the matter I present to be worth a few minutes consideration.

Last September in conversing with Mr. ATKINSON on other matters, he mentioned his desire to determine the loss of strength in cotton fibres when subjected to the various processes employed in converting seed cotton into finished cloth. It was at once apparent to me that any attempt to determine the average strength of single fibres in a lot of cotton would necessitate the testing of an enormous number of fibres. A pound of cotton contains at least one hundred million fibres and the strength of the fibres varies widely. One hundred thousand is a low figure for the probable number of fibres which must be broken to obtain a clear notion of the effect of all the successive processes on one sample of cotton.

Taking the only method of which I find record, it is not possible for one operator to test 100,000 fibres in several years, and the work is so trying to the eye and head that one operator would scarcely last to complete the task.

I became much interested in the subject, believing it to be a simple matter to make a recording testing machine which might be operated at a fair rate of speed. It was not a simple matter,

however, and instead of taking three weeks as I expected, it has required six months, and a very considerable amount of patience.

The machine which I have finally gotten into successful operation is wholly the work of my own hands, and shows plainly, to me at least, the advantage of what we at the Institute consider as essential in a technical education, a training of mind and hand to mutual service. I could have designed the machine, but I fear I must have failed had I been wholly dependent upon anyone else to translate my ideas into brass and steel.

It is not desirable in view of the incomplete state of my research, and our natural wish to have the field to ourselves a little longer, to present to you now the details of the mechanism. Suffice it to say that I can extract from a mass of cotton, fibre after fibre, insert them one by one in the machine, operate the keys, repeating again and again at the rate of at least 150 an hour, and at the end of that time take from the machine a paper ribbon stamped with the tensile strength of each fibre, correct to the nearest grain. I have done this two or three hours each evening at the close of a day's teaching, for some time, and as yet I find no indication of undue strain of anything other than the muscles of arms and wrists, due to the cramped position.

A later machine involves an averaging device, and records grains and tenths. The machine is not patented, and I must at this time, refrain from detailed description of the mechanism by which its functions are accomplished.

The first question to be settled when the machine was completed was "what constitutes a fair sample" of a lot of cotton.

Taking a bale of Uplands cotton, which had been ginned on a saw gin, and a second bale of the same cotton which had been ginned on a roller gin; third a sample of seed cotton, and fourth a sample of yarn, I find in all cases except that of the seed, that 100 fibres carefully selected give the average which is correct within two per cent.

One hundred fibres give a sample which is correct within one per cent. In the case of seed cotton the lack of uniformity in

different bolls makes it necessary to double the number of fibres to insure the same precision.

The study of the effects of the various processes on the strength of the fibres was carried on by means of samples of 200 or more fibres in each instance. Selection was made from each lot of cotton by taking several handfulls and mixing and quartering until a tuft about the size of one's clenched hand was left. This was then taken to the machine and fibres taken from all parts of it were tested one by one. I will now give some of the results we have reached.

An examination of the seed cotton shows that the variation in strength of the fibres attached to any one seed is not large, but that different seeds in the same lot have very different sets of fibres attached to them. Thus, while all the fibres attached to one seed may have a tensile strength between 90 and 100 grains, the fibres attached to the next seed may have a tensile strength of from only 30 to 40 grains. Taking, however, twenty seeds and testing ten fibres from each, and then repeating on twenty more seeds, we find the two averages to agree closely in nearly every case.

It is possible that some light may be thrown on the treatment of growing cotton by the study of its fibre strength.

Coming next to the saw gin, we find considerable damage to the fibre. While I can not yet give you any very clear notion of the number of fibres which are broken in short pieces, I am satisfied that it is a considerable percentage of the whole. If a fibre be grasped at the end and pulled, it breaks near the seed with a much less tension than is necessary to break the fibre near the middle, but when we consider that the pull on the fibre in a saw gin is given by the friction of a sharp steel tooth moving at a rapid rate, it does not appear certain that the fibre will break at what was originally its weakest place. Figure 1, *E*, shows the fibre on the saw tooth, *F*. At any rate some saw ginned cotton samples show fibres which have lost 10 per cent. of their average strength in ginning and others 25 per cent. Some of the samples which do not show so much im-

pairment in strength on ginning have many short fibres which are more than ordinarily strong. What probably happens is that when a fibre is broken in its weakest place each of the two pieces will be a little stronger than the original fibre. This is easily shown experimentally.

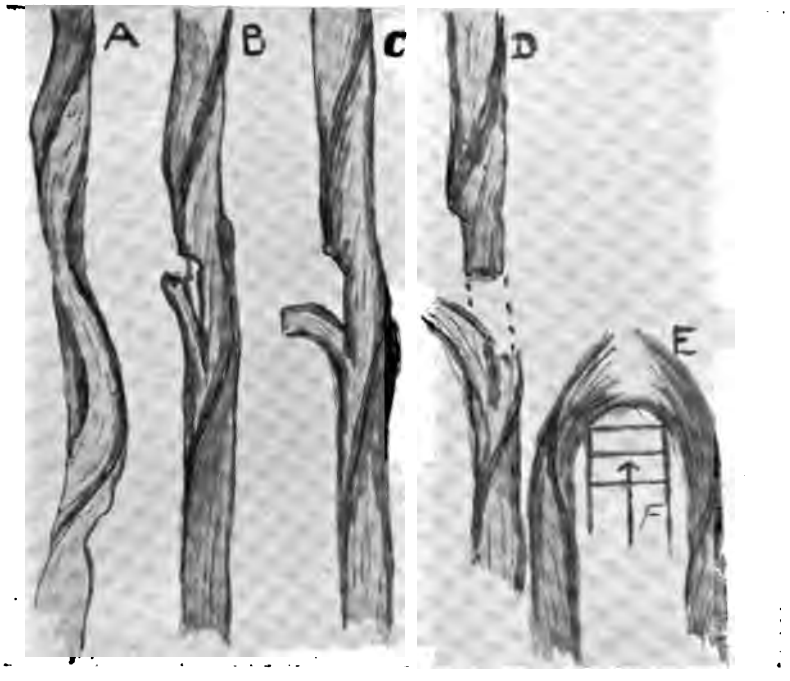
The roller gin causes no such diminution in tensile strength, and in some cases I was surprised to find the average strength after ginning on a roller gin was a little higher than before. This also is probably due to the fact that many fibres are broken at their weakest point without the additional mutilation of the saw gin, thus raising the average strength of the whole.

It is proposed to study the lengths of the fibres by means of an enlarging lantern and an integrating wheel. We will hold a tuft of the cotton between two glass plates and project its enlarged image upon the wall and trace over the fibre with an integrating wheel. This method was suggested to me by Prof. F. A. LAWS of the Institute.

Many fibres of saw ginned cotton break in a manner which may indicate the nature of the damage done by the gin. The fibres show no sign of damage until put under tension, then a small spur appears on one side of the fibre twisting and writhing as the tension of the fibre increases, standing more nearly perpendicular to the fibre until the fibre breaks at the base of the spur. This action is indicated on Figure 1, at *A*, *B*, *C*, *D*. I have found some fifty such fibres in saw ginned cotton, and only one in cotton which had not been saw ginned.

Moisture has little effect on the tensile strength of fibres. If a fibre be put in tension and moistened in one place it is certainly no more likely to break in the wet portion than in the dry.

The processes subsequent to ginning seem to have very little effect on the fibre as indicated by an impairment of strength. Three samples of cotton have been followed with care from seperator to fly frame without losing more than two or three per cent. of their fibre strength. I believe the reason is this, that the blades of the beaters and pickers never get very near the



ABRASION OF COTTON FIBRES BY THE SAW GIN.

cotton. At the speed at which these blades go they must carry such an air cushion ahead of them that many of the blows they deliver must be those of a jet of compressed air rather than that of wood or steel. As to drawing rolls I can imagine why the fibres are not damaged when so loosly held together, and when one end of a fibre is held fast under one roll and the other end is pulled by the traction of the roller ahead, there can only be one result, that is a sharp clean break.

I have just tested samples of cotton from the American Cotton Co., to determine the effect on the fibre strength of the process of cylindrical baling. There is no perceptible difference in fibre strength before and after passing under the compression rollers.

A few pieces of bleached and unbleached cloth have been examined, and I need scarcely tell you that the fibre is weakened by bleaching, in amounts varying from ten to thirty per cent.

To repeat then, I believe we have shown, 1st, that the cotton fibre is damaged in saw ginning from 10 to 25 per cent, and is, moreover, somewhat broken into short pieces, and that the roller gin, while it *may* break up the fibres, does not sensibly lower their average strength.

2nd. The subsequent mechanical processes do not lower the tensile strength of the fibre by more than two to five per cent. from the separator to fly frame.

3rd. Some bleaching, at least, is damaging to the fibre.

4th. The cylindrical baling process of the American Cotton Co. is not injurious.

5th. A good idea of the strength of a sample of cotton may now be gotten in an hour's time.

Mr. ATKINSON has purchased three bales and four bundles of cotton, all from the same field, giving us samples of first, the seed cotton; second, the same cotton ginned on a saw gin in the best manner possible; third, the same cotton ginned on a saw gin at high speed; fourth, the same cotton ginned on a roller gin; fifth, three sets of samples taken during processes of manu-

facture, and sixth, many different kinds of American seed cottons which have not yet been examined.

It seems to me more than probable that a further insight into the varying strength of fibres may be not only interesting scientifically but of value commercially, and it is our hope to be able to continue further in the investigation.

I wish to express my thanks to Mr. W. W. CROSBY and his able and courteous co-workers at the Lowell Textile School for their valuable aid in furnishing us with samples from processes of manufacture.

I trust you will bear in mind that a large portion of whatever of value you may find in this research is due to Mr. EDWARD ATKINSON, who has been, not only the financial, but scientific and commercial motive power for the undertaking, my part being to make for myself a tool with which to do the work under his direction.

Professor NORTON exhibited his machine to the Association and illustrated its operation, and the demonstration was greeted with hearty applause.

The PRESIDENT. Owing to the lateness of the hour I have thought it best that we take up the next article on "Roller Ginning," by Mr. E. W. ATKINSON and then if there is time for discussion discuss the two points together, as they seem to be somewhat connected.

Mr. E. W. ATKINSON. Mr. President and gentlemen, the hour being late I shall not trespass upon your valuable time by reading the paper on roller ginning which I had prepared. You have a printed copy before you and can read it at your leisure.

Much of the afternoon has been taken up in the very interesting discussion of the round bale, and especially upon the wonderful production of Professor NORTON. That Professor NORTON should have been able to invent and construct such a perfect fibre testing machine, I think you will all agree is a most remarkable achievement, and that the cotton manufacturing industry will in future derive very great benefits from its use.

There remains only one point that I wish to bring out distinctly, viz., that the result of Professor NORTON'S tests show that cotton grown upon the same field ginned upon the roller gin shows an enormous increase in tensile strength over the same cotton ginned upon a saw gin. This fact in connection with the paper I have prepared is of great importance.

ROLLER GINNING.

E. W. Atkinson, Boston Mass.

You have heard a great deal upon the subject of "Roller Ginning," in one way or another during the past few years. You have no doubt, many of you, received samples of very beautiful looking cotton, and as no large lots of cotton have yet turned up to correspond to these samples, you, very probably, have come to the conclusion that so far as roller ginning is to have any effect on the American cotton crop, it will not amount to much. Such things, however, must of necessity move very slowly at the start. In the last few years a great deal of experimenting in this direction has been done, and I venture to predict that it will not be a great while before our entire staple crop will be ginned and handled upon this system.

In 1894 I had the opportunity of visiting some of the large cotton ginneries in Egypt, and also of examining the methods of putting this cotton up for the market in Alexandria. No doubt, some of you gentlemen have also done the same thing, and you must have been struck at once by the very systematic manner in which this crop is prepared for the market. The system is so utterly different from anything that we know of in this country at the present time that it will bear a little further explanation.

In the first place the ginneries are comparatively few in number and large in capacity. The single isolated country gin, which is to be found most everywhere throughout the South, does not exist. The result is that the cotton is brought to the

FIGURE 1. PLANT OF ADVANCE GIN AND MILL CO., VICKSBURG, MISS.

FIGURE 2. SAW GIN STAND AT ADVANCE GIN AND MILL CO., VICKSBURG, MISS.

central ginnery in the seed. It is there carefully selected and graded, each particular quality being placed apart by itself. This is all done before it ever touches the gin, and, therefore, the ginned cotton presents much greater uniformity in character than can ever be the case where the cotton is ginned first, just as it comes from the field and then graded, after it is baled up and goes to the compress.

In going through an Egyptian ginnery, one is struck by its strong resemblance to a card-room in one of our mills. It goes without saying that there is not a saw gin running in Egyptian ginneries. They have been tempted by the large output of the saw gin to experiment with it, but have invariably thrown it aside on account of the great injury it does to the fibre. In one of these ginneries will be seen two or four rows of roller gins, with anywhere from twenty-five to fifty gins in a row. The cotton is all fed in by hand at the back, and comes out in the delivery-alley at the front, in a very beautiful silky sheet of lint, which is again gathered up by hand and placed in a truck, and thence taken to the packing room, where it is put into sacks. These sacks are all shipped to Alexandria by one way or another, and are there again regraded and compressed into the well known modern Egyptian bales of cotton.

You are all familiar with the uniform manner in which this cotton runs; you never have any claims to make for short weight, or for irregularity of staple, or strength of fibre; you buy it on type, and you know that the shipment is absolutely certain to be equal in every respect to the type on which you bought.

To anyone examining the methods adopted in Egypt, the thought occurs here why are not the same methods adopted in handling the American crop. You are all familiar with several of the new baling processes now being adopted largely, and with great success for the baling of our cottons. It seems to me that we have begun to make our improvements here at the wrong end of the line. The commencement really ought to be begun upon the cotton field, but as long as the saw gin is uni-

versally used for our staple cottons there is very little encouragement to the planter to do much in the way of improving. You will hear from others some account of the injury done by the saw gin, so that I will not enter into the subject beyond stating the fact.

With these ideas in mind, I had the pleasure of making a trip through the South in 1895, with the late Sir BENJAMIN DOBSON, of whom we all have such pleasant remembrances. It had been the commonly accepted fact that it was impossible to gin successfully our green seed American cotton with a roller gin, as you are aware. Our Sea Island cotton has been ginned on this system for many years, and having a black seed to which the lint does not stick, it works in the roller gin in just the same way as does the Egyptian cotton. On the contrary with the ordinary American green seed cotton, difficulties at once presented themselves. Several experimental roller gins had been tried, and because they did not start right off to do the work, they were given up as a bad job, and as stated, it was the commonly accepted theory throughout the cotton growing district that a roller gin would never be of any use in this country. Sir BENJAMIN DOBSON did not hold this view, he having had a large experience in making cotton gins for Egypt and India, and he felt positive that the American cotton could be practically and successfully ginned upon this class of machine.

Through the kindness of Mr. E. P. TAFT, of Providence, and Mr. W. L. WELLS, of Vicksburg, we were introduced to a gentleman who was described to us as the most practicable cotton ginner in the South; I refer to Mr. R. DERDEYN, of Vicksburg, who will shortly supplement my remarks. He was at that time running a saw gin establishment, and agreed that if we would give him a gin to experiment with, he would make it go; accordingly a roller gin was shipped to him. He will inform you in what manner it succeeded. The regular Egyptian form of gin was found to need some modification, in order to give the best result; accordingly the next year these were made, and a second machine forwarded to him with better results than before.

Of course, you will understand that the output of a roller gin is very much smaller than that of the saw, and we at once ran against the difficulty of overcoming the high labor cost of feeding these machines. In Egypt this feeding is all done by hand by a large number of small boys and girls, who are paid very low wages, and unless something could be devised to overcome this high labor cost it was thought that the roller gin could have no place in the South. Mr. DERDEYN has overcome this difficulty to a large extent, and has been able to get down the cost of roller ginning very materially. It will, however, always cost more per pound to gin cotton on the roller gin than on the saw, but the enhanced value of the product will more than counterbalance the extra labor put into it.

As a result of the foregoing experiment, it was not until late this season that there was set up in Vicksburg the first battery of roller gins ever run in this country, and the first battery of roller gins ever run anywhere, which were not fed by hand, and if you will look at cut No 3, you will see the result, and I do not think I overstate when I say that this is the best and most economical roller gin plant that exists anywhere today. Of course, during all the time we were experimenting on the sample gins, a certain quantity of cotton was put through them with very interesting results.

When we got the first gin running, for instance, we bought a small quantity of cotton in the seed. It made only three or four bales of lint, half of which was ginned upon this roller gin and one-half upon the newest and most improved saw gin. We submitted the samples of the two ginnings to a very large number of manufacturers, with a request that they would report upon the same, and give us their opinion as to the difference in the value of the two styles of cotton. While, of course, not a great deal of reliance could be placed upon the results of such small samples, still, in a general way, they might be expected to show a marked difference if difference existed.

From the 50 sets or more of samples that were sent out, there were perhaps 25 answers received, and in no case was the

value of the roller ginned sample placed at less than one cent per pound in advance of the value of the saw gin sample, and you may be surprised to hear that in some cases a difference was placed as high as 4 cents. It was not believed by many that the cotton had ever been the same in the seed. The bales were tested in a rough-and-ready way in one of our New England mills, and some curious results were found. The roller gin cotton carded much better, made a stronger yarn, with less waste, and required the twist gears to be changed all through the machinery, as it was found that the same result could be obtained with less twist.

During the second year of our experiments, we bought a larger lot of cotton in the seed, which yielded altogether eight bales. This was also treated as before, but owing to the strike among our operatives at that time it was not possible to have it spun up in this country. It was shipped to England and worked up in a well known Bolton mill, with the same results as before. The roller gin was pronounced to have a longer staple, yielded less waste in its work, carded better and handled better throughout the machinery, and finally made a more lustrous, stronger and better yarn. These are the only practical results that have been attained thus far.

We had hoped this year to have a fair quantity of this cotton to offer, but as is usual with a new enterprise, there are inevitable delays, and it is only lately that the plant has been put into running order. Beside this, our friend, Mr. DERDEYN, has been so overwhelmed in the delinting department of his concern that his time has been all taken up in filling seed contracts abroad. Again, the crop this year, as you know, has been a very poor one; dirty, wet and of poor quality.

We have, however, at the present time, a dozen bales from this roller gin battery, being worked up in New Bedford, and I had hoped to be able to give you the result of carefully made tests. The mill, however, had so short a time, that they were unable to get the cotton through. I have here some samples of this product, which I would be glad if you would examine in

FIGURE 3. ROLLER GIN BATTERY AT ADVANCE GIN AND MILL CO., VICKSBURG, MISS.

FIGURE 4. DELINTING STAND AT ADVANCE GIN AND MILL CO., VICKSBURG, MISS.

reference to lustre, absence from knits, etc. I would add that during the early part of the year, we brought a further small quantity of cotton in the seed; had part of it ginned on the best make of saw gin, and part on the old fashioned country saw gin and part on the roller gin. The result of careful examination of this lot will be given you in another address.

It may interest you to know that in spite of the necessary extra expense, interest charge, etc., which always accumulate during times of construction, our little corporation has, nevertheless, been so successful in its other branches that it has shown a profit for the first seven months of its existence. It is not the intention of those interested in it to attempt to go too fast, or to place its stock upon the stock exchange, but it is their hope and expectation to make the successful beginning of what may develop later into a general improved system of handling staple cotton, of which this country is and can be such a large producer. We feel sure that this will be welcomed by all who use this class of cotton in their mills.

I am very much pleased that Mr. DERDEYN, the manager of this company, is able to be present here with us today, and I am quite sure that he will be able to give the members of this Association a great deal of new and practical information on the general subject of cotton handling in the South.

DISCUSSION.

R. DERDEYN (By Invitation of the Board of Government).

It is indeed a privilege to me, a Southern cotton ginner, to address you, the members of an association representing the most important industry on this whole continent. The most important industry, because its prosperity affects a larger number of American citizens, than would be affected by the collapse or success of any other two industries.

Let the pulse of the large engines, putting life into the iron or sugar mills of this country, cease throbbing and only the people of their immediate vicinity and a few thousands of coal and iron miners or sugar planters would suffer; but the hardships caused by a shut down of your mills would be felt not only by your operatives, by your machine shops, by the miners furnishing your coal, but also by the millions of cotton planters throughout ten States and two Territories.

Yet, how is it, that the cotton planter, at the present moment, does not share in the prosperity of the country in general and your industry in particular? What is it that makes him poorer and poorer every year and reduces him slowly but surely from a planter to a pauper?

Ask him, himself, the cotton planter; ask the millions of them, and to a men they will say "The low price of cotton."

This is a signal error. This answer is only true in so far that low priced cotton makes him feel more keenly the old time perquisites still levied by the thousands of vampires and barnacles surrounding him; and mainly in that the low price of cotton is the effect of the following cause, to wit: "The

FIGURE 1. COTTON PICKING.

FIGURE 2. HAND FEEDING COTTON GIN.

unbusiness-like, wasteful and careless manner in which cotton is being handled by himself as well as by the afore-named gentry.

When cotton opens all the thoughts of the planter are centered on picking it, so whether the snowy flakes are dry or wet with dew or recent rains, the pickers are sent forth to gather them. As pickers work mostly by the hundred pounds, they are not overparticular; and thumb leaves, hulls, limbs, and quite frequently lumps of dirt and mud find their way into the sacks to make up the weight of the day's picking. The cotton is emptied out of the picking sacks in baskets, hauled to the cotton house or is piled on the turn row to lay there exposed to the elements until it is hauled to the cotton house or the gin.

The whole family accompanies the cotton to the gin; and by looking at the accompanying photographs, which are fair samples of the general run of gins and gin machinery at the disposal of the large majority of planters, you can imagine all are needed. The cotton is taken out of the wagon in baskets and put in the hoppers over the gin machinery. Photograph No. 2, shows a gin stand in which the cotton is fed by hand. Photograph No. 4, a gin stand having an automatic feeder, and they give you an idea of the expensive manual labor it involves.

The operation of the saw gin, barbarous and hurtful of itself, is made the more so by the careless manner in which it is performed. One thought predominates gin owners, and that is to get out all the cotton possible in the least time. Negroes are taken out of the fields to fire the boiler, run the engine, feed the gins, bale the cotton; and, when in the morning, steam is up, *let 'er go!* is shouted, and she goes until something bursts; always at the same reckless gait, the full speed of the groaning, squeaking, little tic-tac engine, regardless of whether long or short, clean or dirty, wet or dry cotton is being ginned, or ever touching the machine for adjustment or cleaning, after it is first set up.

The delicate operation of separating the seed from the lint cotton, in fact, the first and most important process of manufac-

turing cotton, goes on in the most barbarous, careless way it is possible to imagine.

After coming from the gin, the lint cotton is put into a long rectangular box, wherein it is tramped until same is full; power is then applied and a bale made. This is wrapped with all the way from 12 to 22 feet of jute bagging, weighing from 1½ to 2¼ pounds per yard, and tied with six iron ties. The bale is given to the planter and it begins its costly journey to the mill.

The first stop it makes is at the compress yard. On being unloaded it is put under a beam scale and weighed. No matter if the ginnery is on the next block to the compress, no matter if the bale of cotton was weighed on a pair of scales weighing perfectly correct according to the city test weights; that bale of cotton is going to weigh less than it did weigh at the gin. In fact, in cases it is brazenly acknowledged that a number of pounds are being knocked off on account of the cotton being freshly ginned, or being first pickings of the season and that the bale is going to dry out.

In this connection it may not be amiss to relate the following authentic conversation between Mr. JERRY, Mr. WILLIE and Mr. ROMAN. Mr. JERRY and Mr. WILLIE are cotton buyers, Mr. ROMAN is a progressive ginner, who can hardly swallow that compresses in his vicinity should intimate by their manner of weighing cotton, that he does not know how to weigh cotton. Getting tired of it he advertised he would guarantee his cotton weights. Shortly after, he met JERRY and WILLIE, and here is their conversation.

Jerry. I see you are going to guarantee the weights of the cotton you gin.

Roman. Yes, sir.

Jerry. Well, are you going to guarantee that these weights will turn out that way at the mill?

Roman. How, what do you mean?

Willie. Yes, you see, guarantee that that bale will weigh that much when it gets to the mill.

Roman. What six months, a year or more after I weigh it?

FIGURE 4. AUTOMATIC FEEDING COTTON GIN.

FIGURE 5. COUNTRY GIN STAND.

Jerry. Why, yes.

Roman. Certainly not.

Jerry. Well, what will you guarantee then?

Roman. I will guarantee that any particular bale of cotton weighs so much at the time it leaves my gin.

Jerry. Oh well, we don't do business that way.

Roman. I know it and it is wrong. When you buy corn now, are you going to knock off five or six pounds per bushel, because it is going to shrink between now and next spring when you use it?

Jerry. Oh, that is different.

Roman. It is not different. I see no reason why you should knock off on cotton any more than on corn, unless the bale should be wet or covered with dirt on the outside.

Jerry. We don't want to pay for more cotton than we are going to get paid for at the mill.

Roman. Yes, I know that samples and sample hole trimmings have got to come out of that bale of cotton, but why should not the people who get the benefit of these samples and sample hole trimmings pay for them instead of making the already impoverished planter pay for them?

And this brings us to the next station on the road of that ever losing bale of cotton. It is called the sampling station.

Its agent the sampler, armed with a sharp knife, such as is used by the butchers to cut the throats of cattle, the effect of the use of that knife by the former being the same on the planter's pocket-book, as is produced by the latter on the beef, and makes a crescent shaped gash 15 to 18 inches long. The buoyancy inherent to the pressed mixture of air and cotton, causes it to bulge out of the hole so made. An iron hook is produced and the cotton immediately on the top pulled out and laid aside. A second pull brings forth more cotton; this is wrapped in paper, and a number put on it corresponding to the number of a tag tied to the bale. This sample is given the planter, together with a receipt and weight certificate, on which the bale of cotton is charged with 50 cents for the privilege of having been mis-weighed and slashed. They, however graciously throw in a month's storage, to quiet the gnawings of their conscience, so to speak. The planter then goes and sells

his bale with this sample and tickets or deposits them with a factor to be sold.

If he were not in such a hurry to leave the compress he would see a man with a long sack next come along and gather not only the loose cotton left on the bales, as stated above, but trim these sample holes for all they are worth and fill his sack with the sweat of the farmer's brow. The sale of this loose cotton goes to increase the dividends of the compress stock holders and kodak No. 1 shows a dray loaded with two large crates of this loose cotton on its way from the compress to the junk-house. Kodak No. 2 shows the cotton being unloaded at the junk house, the latter being situated, in this instance, immediately next to the Cudahy Packing Company's store room.

After that, the samples come out of that bale thick and fast; every factor, commission man, or buyer, has to have one; of course a trimming accompanies each sampling and what is spilled during the operation is picked up by the man with the long sack to swell the pile at the junk-house and the dividends of the compress company, and it, together with the samples and trimmings of the other sweaters, goes to make the immense cotton crop raised on the few acres planted in the cities with compresses and cotton yards; a crop amounting to well nigh one per cent. of the total cotton crop of the United States.

In cases where the cotton is handled by a factor, the weighing heretofore spoken of is done when the bale is delivered to the buyer, and the planter is then settled with by that weight; that is, by the weight the bale weighs after it contributed its share to all the above samplings and trimmings.

That bale of cotton is finally sold to a cotton mill. It is then compressed, from which a charge from 10 to 15 cents per 100 lbs. is made; rolled on platforms; loaded in cars; unloaded on wharves; put in the holds of ships where it is screwed, chopped off and mangled until it fills its allotted place. All this is done, more or less, in rain or shine, through mud or dust, and when the cars or the ships are not available, the cotton is just as soon left unprotected as not, and it arrives at the mill in all sorts of conditions.

FIGURE 6. COUNTRY GIN STAND.

The first operation cotton undergoes at the mill is to undo the work of the compress; the second is to repair the damage caused by the careless cotton pickers in the field and the ginner in the gin; and it is only after it goes through both that it is in a fit condition for the lapper, that is, in a condition in which the spinner, the manufacturer of cotton, can properly take hold of it and convert it into yarn and cloth.

After describing the fearful manner in which the cotton is handled, let us now have the figures of the losses incurred thereby. These losses are of two kinds. First, losses that can be avoided by the planter; next, expenses which he cannot avoid under the present system of handling cotton. For an illustration we will take as a basis a bale of cotton weighing 500 pounds.

Worth under present circumstances 5 cents per pound or		$25.00
The list of unavoidable losses includes,		
The cost of picking 20 per cent. foreign matter in the seed cotton, it taking that much more seed cotton to make the bale of lint; 300 pounds at 40 cents per 100,	$1.20	
The difference between good and bad ginning, which will average 1 cent per pound, 500 pounds at 1 cent,	5.00	
Loss caused to the spinner by the foreign matter in the cotton, the cost of taking it out of the cotton and the freight paid on this foreign matter, all of which he, of course, deducts when figuring on the price of the cotton. Placing it low, we will make this 10 per cent.,	2.50	
Total,		$8.70
Or this planter could have obtained for that bale of cotton instead of $25.00,		$33.70

Let us now consider the list of expenses attached to the sale of this bale of cotton.

Ginning, wrapping and pressing,	$2.50	
An average deduction in weight of 8 pounds or loss by sampling at 5 cents, price obtained,	.40	
Weighing and sampling,	.50	
Fire insurance ½ of 1 per cent.,	.15	
Commission on sale 2½ per cent.,	.63	
Compressing 12 cents per 100 pounds,	.60	
		$4.78

Deduct this amount from the $25.00 value of the bale and it will be found that he really received only $20.22; or in other words, that his entire year's toil netted him only 60 per cent. of what it might and would net him were this unbusinesslike, careless and wasteful manner of handling cotton done away with.

It is safe to assert that a system of handling cotton from the field to the mill can and must be inaugurated, by which a planter can save the above named amounts; a system that will do away with the enormous amount of labor now expended on hauling cotton to and from fields, cotton-houses, gin-houses, landings, cars or compresses, and that will do away with opening and picking rooms, beaters and cleaners in cotton mills; in fact, furnish the latter with a compressed continuous lap of clean cotton ready for the finishing picker in mills where coarse goods are made or only one class of cotton is used; or ready for a lapping machine in mills where it is desired to mix several kinds of cotton.

Add to amounts already named, the amounts represented by the elimination of these operations, and further add to them the amount saved by doing away with that greatest firebrand of all in a cotton mill, the opening and picking rooms; add, also, the amounts saved by paying freight only on clear cotton, and it will be seen that such a system would bring to the Southern planter 90, or even 100, per cent. more for his cotton than he receives at the present moment; *and that*, without enhancing the cost of the raw material to the cotton mills one particle, in fact, the system would bring the mills nearer the fields, and cheapen to them the manufacture of cotton.

What is this system that will transform that 5 cents cotton curse into a 10 cents cotton blessing?

To begin with, we must give the credit of originating this idea to the eminent economist, Mr. EDWARD ATKINSON. This system of handling cotton from the field to the mill is as simple as it is effective. Under this system the planter will pick his cotton as clean as possible; if damp he will dry it, and when dry will haul it at once to the gin, where in five minutes, with possibly the assistance of his factor alone, he will sell and unload his seed cotton and receive therefor a sum equal to nearly double what he is receiving at present; a sum free from any of the old time perquisites. He has no further worry or trouble with that cotton and he can go home to pick more cotton or attend to his other crops. His part is played and the ginner steps in.

The latter, after sampling and classing the cotton will unload the wagon and store it in his large warehouse where he will have as many compartments as there are various classes of cotton raised in his neighborhood. When he has a sufficient amount on hand of any one class, he will gin this cotton on the most improved machinery and with the best labor. Attached to his gins will be a machine scutching, lapping and compressing the cotton into a round bale, of nothing but pure, clean cotton ready for the apron of the carding engine.

This cotton will be sampled while being ginned; when wrapped, the bale will be branded with that ginner's brand for that particular class of cotton; the net weight will be stencilled on it and it will be stored until such time as it is needed to fill an order from some spinner for a number of bales of its brand. The bale will be neither mishandled, slashed or otherwise damaged in transit, as the ginner will guarantee the weight and the class of the cotton, and thus his part ceases and the cotton made only one stop on its journey from the field to the mill.

The South has awakened to the fact, that cuts and savings must be made; it is fast realizing that the huge, expensive compress has seen its days. This is proven by the many thousands of dollars now being spent in the effort to produce machinery

to compress cotton at the gin; but these improvements do not go far enough, and by the force of circumstances, created by our fast moving world and the laws of the survival of the fittest, they will soon lag behind, as not one embraces the system alluded to; and while they may effect a small saving here and there, not one takes the straight line from point to point, to wit: takes the cotton direct from the fields to the finishing picker.

As I am talking to you, gentlemen, I can hear the wails of the critics, the vampires and the barnacles, holding up their hands in holy horror, and demean themselves like the devil immersed in a tub of holy water. "Hold on," they say; "you exaggerate; in our neck of the woods, we only charge so and so, or we do not do so and so." I know perfectly well that a part of the cotton raised in this broad land is not treated as badly as I have described, but, I also know of a much larger part of the crop that is treated a good deal worse. Rules are always confirmed by exceptions, and, in this matter like in political conventions, the majority obtains.

I can further hear them say: "But your ideas are impracticable; you cannot sell cotton that cannot be sampled." This is not so. Reputable, honest ginners will be able to sell their cotton year in and year out, by the name they choose to give it; just like grain dealers sell No 1, No. 2 or No. 3 wheat for what it is.

The new system of handling cotton from the field to the mill, far from being impracticable, is, in fact, the only system manufacturers as well as planters and ginners, can afford to adopt. Supposing one cotton mill would be lucky enough to secure cotton put up as per that system. Would not every other cotton mill, in that line of goods, be unable to compete with it, and be compelled in self defence to enter the ginning field and establish gins on the new system, each one for himself, in the territory where they get their cotton from, if they could not obtain such cotton any other way? The system is so practicable

that the next season will see on the market, and for sale to the spinners, cotton put up in that manner.

In the foregoing, gentlemen, I have endeavored to give you an impartial and correct description of how the cotton is handled at present in the South, and have given you my views as to how the prevailing evils of badly baled and badly handled cotton could be best eradicated. It remains for me to thank you for the privilege that has been given me of addressing you, also to ask your indulgence for the foreignisms I may have committed.

AUTOMATIC CONVEYING FROM STORE HOUSE TO PICKER ROOM.

EDWARD W. THOMAS, Lowell, Mass.

At a meeting of this Association held at the Profile House in September, 1896, the writer presented remarks relating to a new system introduced at the Tremont & Suffolk Mills for automatically conveying cotton from the store houses to the various picker rooms. The system at that time had been in operation but about six months, and our brief experience with it up to that date seemed to warrant its permanent success. Now after two years experience with it I am glad to say that with certain improvements we find it today fully up to our original expectations.

In response to inquiries from different sections of the country asking as to the successful operation of the system it has been suggested by the Secretary of this Association that any additional information might be given.

At these mills there are three picker rooms with self feeds and openers in them, each room being supplied from pipes leading to various store houses. I will take but one of these picker rooms, containing fifteen sets of self feeds and openers. This room is about 900 feet away from the store house that supplies it. About 900 bales of cotton are used weekly in the room, and inasmuch as the warp and filling cottons are different in their class we have two complete systems of pipes and fans running from this room to the store house. This is done also that both classes of cotton may be run to picker at the same time. Hav-

ing at the same time an opportunity of crowding one line should anything happen to the other one.

As stated before the nearest points between the store house and picker room is about 900 feet.

The store house, or more properly speaking, houses, are of wood, one story in height — about 24 feet high — are two long buildings, 330 feet in length and 75 feet in width. Each of these buildings is divided into five compartments by brick walls extending above the roof and beyond the line of the outsides of the buildings. These cross walls have no openings in them. The two buildings are about 18 feet apart and the two sides next this passage way are of brick with two doorways into each compartment. Through this passageway between the buildings is the spur track upon which cars laden with cotton are received. In the end compartment of one of these buildings all cotton required for each two days consumption is taken, and the covering and hoops removed. The ends of the two pipes previously referred to have funnel shaped mouths into which the cotton is thrown.

The tubes are 18 inches in diameter and pass under a public street, through the basement of a mill, then rise to the second floor of another mill. At this point are located the fans that suck the cotton from the store house from this point on. The cotton after passing through the fans is blown to the picker room through same size pipes.

As the pipes enter the picker room, cotton passes through about forty feet in length of dust trunks of the ordinary make except somewhat narrower. These are fully protected by automatic sprinklers. At such points along the rear of the self feeds as are desirable are located Kitson condenser heads, the design of these being to allow the air that has been drawn over with the cotton to be removed by a system of piping connected with an exhaust fan and discharged into the dust room below. This allows the cotton to fall directly to floor without being blown about.

ADVANTAGES OF THE SYSTEM.

First.—A minimum quantity of loose stock in the picker room at any one time, as but just enough cotton may be maintained on floor to feed into openers.

Second.—All the advantages of airing the cotton by opening the bales in the storehouse may be had that are in the picker room.

Third.—The saving in handling the bale beyond the placing in the opening room and saving of transportation that involves either trucking by hand or by teaming.

Fourth.—A better condition of stock fed into openers, as it is thoroughly broken up and loose and in good shape for the self feeds and openers.

Fifth.—No special necessity for the storehouse to be placed adjacent to the picker house, for it may be quite remote and the system is perfectly practicable within reasonable limit.

Sixth.—The position of the exhaust fan or blower may be at the storehouse, part way along the line of conveying pipe or at picker end at a point wherever power can be readily and conveniently obtained.

We do not claim originality of this system, as our friends the woolen manufacturers have used it for years in conveying stock, both wet and dry, but adopted and applied it as a labor-saving device. In these days of close competition we are forced to adopt any and every means of reducing expenses by the introduction of any and all improvements that are practically of an economical nature.

The PRESIDENT. As we have now concluded the long and varied program of valuable papers, I now declare the sixty-sixth meeting of the New England Cotton Manufacturers' Association adjourned.

INDEX.

A

Active Members, By-laws of . . 5
Active Members, List of. . . . 13
Adams, Alfred E., Elected Director 95
Adams, Alfred E., Investigation of Cotton Fibre 99
Advantages of the Electric Driven Cotton Mill, W. B. Smith Whaley 315
Advertising, Income from . . . 75
Allis Company, Engine Installation 301
American Cotton Co., Methods of Sampling 359
American Locomotives used in England 119
Amory, Frederic, Elected an Active Member 91
Anderson Cotton Mills Electric Drive 327
Asbestic for Fire Protection . . 279
Asbestos Board 276
Associate Members, By-laws of . 6
Associate Members, Election of 93
Associate Members, List of . . 26
Atkinson, Edward, Automatic Sprinklers 223
Atkinson, Edward, Cyclone Dust Collectors 224
Atkinson, Edward, Cyclone Dust Collector 286
Atkinson, Edward, Discussion of Norton Testing Machine . 99
Atkinson, Edward, Effect of Iron in Mill Structures 275
Atkinson, Edward, Fibre of Cotton 383
Atkinson, Edward, Interstate Commerce Law 371
Atkinson, Edward, Originator of Improvements in Ginning Cotton 423
Atkinson, E. W., Roller Ginning 400
Atkinson, Edward, Spread of Fire by Gas 281
Atkinson, Edward, Spread of Fire by Varnished Surfaces . 285
Atkinson, Edward, Whitewash as a Fire Retardent 284
Attendance at the Sixty-sixth Meeting 51
Auditor's Report 74
Auger Sampler for Cotton Bales 364
Automatic Conveying of Cotton from Storehouse to Picker Room, Edward W. Thomas . 426
Auxiliary Power Plants with Electrical Transmission, Frank P. Sheldon 298

B

Bailey, Charles L., Committee on Ballots 95
Baker, C. M., Early Cotton Mills at South 138
Ball, D. C., Sampling Round Bales 357
Banding, Power Absorbed by . 344
Barker, Louis B., Elected an Active Member 91

Bates, Daniel Moore, Jr., Gray Goods from the Bleacher's and Finisher's Point of View . . . 226
Belting, Philip Dana 270
Benson, A. M., Elected an Associate Member 93
Blower Method of Conveying Cotton 427
Board of Government 9
Board of Government Meeting . 78
Borden, Jefferson, Jr., Elected an Active Member 91
Boston Duck Company, Electric Transmission 330
Boston Society of Civil Engineers, Invitation of 86
Bourne, Stephen N., Cyclone Dust Collectors in Picker Buildings 288
Bowen, Frank A., Dust Collectors in Napping Rooms . . . 293
Bowman, Dr. F. H., on Strength of Cotton Fibre 383
Brooks, Christopher P., on Second-hand Machines in Textile Schools 145
Burnham, Hervey, Elected an Active Member 91
By-laws 5

C

Call to Sixty-sixth Meeting . . . 59
Care of Belting, Philip Dana . . 270
Chadwick, Capt. H. S., Obituary Notice of 49
Charter 3
Clarke, Frederick E., Elected President 95
Cloth, Drying of, Alfred A. Hunting 256
Cadwell, William D., Experience with Electric Transmission . . 330
Chapin, E. P., Experience with Electric Transmission 329
Childs, E. G., Experience with Electric Transmission 330
Cloth, Large Rolls of 253
Colored Goods, Cost of 189
Columbia Mills Company Electric Drive 328
Combination of Effort 107
Commercial Museum, Philadelphia 152
Committee on Ballot for Election of Members 93
Competition of Southern Mills in 1850 138
Constitution and By-laws . . . 5
Corkscrew Used to Sample Round Bale 376
Cost Account Books 176
Cost Finding in Cotton Mills, Methods of, Wm. G. Nichols 173
Cost of Electric Motors 342
Cost of Maintaining Association 77
Cotton Fibre, Experimental Investigation of 99
Cotton, Fibre of, Edward Atkinson 383
Cotton, Frank H., Elected an Active Member 91
Cotton Importations into Cuba . 170
Cotton Manufacturers' Association Medal 79
Cotton Trade with Our Newly Acquired Territories, Dr. Wm. P. Wilson 157
Crosby, W. W., Lowell Textile School 398
Cuba, Commerce with 169
Cuba, Cotton Trade with . . . 150
Curwen, C. F., Elected an Associate Member 93
Cyclone Dust Collectors 287
Cyclone Dust Collectors in Picker Buildings 288

D

Dana, Philip, Committee on Ballots 95
Dana, Philip, What Belting is Made Of and Its Care 270
Dederick Square Bale 380
Defects in Cloth 238
Dempsey, Wm. P., Burlaps on Goods 249
Dennett, Charles W., Saving of Floor Space by Electric Drive 335
Depreciation, Joseph Nasmith . 126
Derdeyn, R., Cotton Ginning . 410
Dexter, Lewis, Jr., Elected an Active Member 92
Directors, Election of 95
Divine, Bradford C., Elected an Active Member 91
Drying of Cloth, Alfred A. Hunting 256
Dust Collectors 224
Dust Collectors 287
Dust Flues, Automatic Sprinklers in 220
Duties of Officers 7
Dwelly, Frank H., Elected an Active Member 92

E

Earnings of Association 75
Eaton, Russell W., Coverings for Bales of Cloth 247
Eaton, Russell W., Oil Stains in Goods 246
Eaton, Russell W., Regulation of Electric Motors 354
Eccles, John, Method of Applying Motors 341
Economy of Electric Drive . . . 323
Egyptian Cotton, Ginneries of . 400
Election of Members 5
Election of New Members . . . 91
Electric Drive, Fallacies Concerning, Sidney B. Paine . . 319
Electric Drive, Increase in First Cost 331
Electric Driven Cotton Mills, Advantages of 315
Electric Drive Saving in Labor . 331
Electric Lights for Weave Rooms 345
Electric Method of Measuring Power 334
Electric Power, Subdivision of . 332
Electricity in Its Infancy, used in 1792 337
Enclosed Arc Lights 347
English Method of Ventilating Card Rooms 295
Export Goods, Packing for . . . 266

F

Fallacies Concerning the Electric Drive, Sidney B. Paine . . . 319
Fibre of Cotton, Edward Atkinson 383
Fibre Testing Machine 392
Fine Filling, Spinning of 352
Fiske, Redington, Elected an Associate Member 93
Flather, Frederick A., Committee on Ballot 93
Flather, Frederick A., on Textile Education 147
Flexibility of Electric Transmission 331
Floor Space Required for Main Belts 315
Floor Space Saved by Electric Drive 335
Freeman, Arthur C., Elected an Active Member 92
Fuller, George A., Obituary Notice of 47

G

Garsed, Joshua, Sampling Round Bales 357
General Expenses in Manufacturing 213
Geographical List of Members . 31
Goodale, Alfred M., Discussion of Cotton Fibre 99
Government, Board of 9
Grant, Henry T., Jr., Automatic Sprinklers 220
Gray Goods from the Bleacher's and Finisher's Point of View, Daniel Moore Bates, Jr. . . . 226
Gray Goods, Make-up of . . . 237
Gregg, William, on Southern Manufacturing 141
Gregson, John, Committee on Ballot 93
Gregson, John, Pins in Cloth . 252
Grosvenor Dale, Electrical Transmission 298
Guarantees of Round Bale . . . 362

H

Hadfield, William J., Elected an Active Member 92
Hadley Thread Company, Electric Transmission of Power . 329
Haight, Effingham C., Elected an Active Member 92
Hair Belts 272
Harris, F. A. W., Elected an Associate Member 93
Hartshorne, William D., Elected an Active Member 92
Hawaii, Commerce with 165
Hawaii, Cotton Trade with . . 149
Headquarters, Change of 78
Hill, Capt. James G., Cost of Power 267
Hobbs, Franklin W., Elected an Active Member 92
Hogg, John, Elected an Associate Member 93
Holmes, Charles M., Elected an Active Member 92
Honorary Members, By-laws of . 6
Honorary Members, List of . . 13
Hose for Fire Protection 219
Hunting, Alfred, Drying of Cloth 256
Hunt's Magazine 140

I

Increased Production from the Electric Drive 322
Indian Buffalo Belts 272
Industrial Institutions, Their Organization and Regulation, Robert E. Walmsley 104
International Trust Building, Association Office 78
Interstate Commerce Law . . . 371
Invention, Cause of Depreciation 129

J

Jackson Company, Experience with Electric Transmission . . 330
James, Gen. C. T., Steam Power in Mills in 1850 140

K

Knight, Stephen A., Coverings for Bales of Cloth 249
Knight, Stephen A., on Electical Transmission 332
Knight, Stephen A., President's Address 67

L

Lancaster Mills Electric Power Plant 321
Langford, W. C., Elected an Associate Member 93

Lawrence, Amos A., Cost of Spinning 139
Lawrence, Rev. William D.D., . 138
Letters of Regret 87
Life of Belts 271
Library 83
Location of Membership 46
Losses of Speed 324
Lovering, Wm. C., Corkscrew Method of Sampling Round Bales 376
Lowe, Arthur H., Committee on Nominations 95
Lowe, Arthur H., Discussion on Industrial Institutions 121
Lowe, Arthur H., Division of Electric Drive 336
Lowe, Arthur H., on Medal System 86
Lowe, Arthur H., Packing Round Bales 373
Lowry Bale 381
Lyall, William L., Committee on Ballots 95
Lyman, Herbert, Opinion on the Electric Drive 329
Lyman Mills, Electrical Transmission 298
Lyman Mills, Electrical Transmission 300

M

Make-up of Gray Goods 237
Manchester Mills, Electric Power 355
Manufacturing, Progress in . . . 70
Massachusetts Legislature, Special Act of 4
Mayor of Boston 65
McArthur, Robert, Committee on Nominations 95
McArthur, Robert, Fire in Dust Flues 223
McDuffie, Fred C., Elected Vice-President 95
McDuffie, Fred C., Investigation of Cotton Fibre 100
McDuffie, Fred C., Steel Mill Beams 274
Measurements of Power by Electrical Apparatus 342
Medal, Establishment of 79
Medal, Vote of Approval . . . 86
Members, Alphabetical List of . 13
Members, Election of 5
Membership, Changes in 80
Membership from Founding of Association 82
Membership, Geographical List of 31
Membership, Location of . . . 46
Membership, Number of 30
Method of Coloring Inside Walls 283
Methods of Cost Finding in Cotton Mills, Wm. G. Nichols 173
Methods of Sampling Round Bale 364
Mill Measurements of Goods . . 236
Moody, George A., Elected an Active Member 92
Motors, Cost of 342
Motors for Portable Power . . . 338
Munroe, William B., Obituary Notice of 48

N

Napping Rooms, Dust Collectors in 293
Nasmith, Joseph, Depreciation . 126
Net Weight of Round Bale . . . 369
New Headquarters 78
New Members, Election of . . . 91
Niagara Electric Plant, Regulation of 355
Nichols, Wm. G., Methods of Cost Finding in Cotton Mills . 173

Nominating Committee for Officers 64
Nominations, Committee on . . 94
Norton, Prof. Charles L., Tests of Cotton Fibre 391
Number of Members 30

O

Obituary Notice of Capt. H. S. Chadwick 49
Obituary Notice of George A. Fuller 47
Obituary Notice of William B. Munroe 48
Officers, Duties of 7
Officers, Election of 98
Oil Stains 251
Oliver, C. K., Experience on Electric Driving 328
Overseer, Duties of 113

P

Packing for Export Goods . . . 266
Packing Goods for Oriental Trade 151
Paine, Sidney B., Committee on Ballot 93
Paine, Sidney B., Subdivision of Electric Power 332
Parker, Walter E., Committee on Nominations 95
Parkinson, Arthur, Sizing, Finishing and Packing Goods . . 263
Past Officers 10
Pelzer Electric Power Plant . . 320
Periodicals at Headquarters . . 84
Philadelphia Textile School, Testimonial Fund 74
Philippines, Commerce with . . 148
Pins in Cloth 252
Porto Rico, Commerce with . . 168
Porto Rico, Cotton Trade with . 150
Potter, Joseph H., Jr., Elected an Active Member 92
Power Cost of 267
Power House, Position of . . . 336
Preliminary Notice of Meeting . 59
President's Address, Stephen A. Knight 67
President, Frederick E. Clarke, Election of 95
Prest, John E., Extra Cost of Round Bales 368
Prest, John E., Fires in Dust Flues 222
Programme of Sixty-sixth Meeting 62
Progress in Manufacturing . . . 70
Protection of Mill 337

Q

Quincy, Hon. Josiah, Mayor of Boston 66

R

Rathbun, Emory S., Elected an Active Member 92
Regrets, Letters of 87
Report of Cost 193
Roller Ginning, E. W. Atkinson 400
Round Bales, Freight of 370
Round Bale, Sampling of . . . 356

S

Salamander Board 276
Sampling Round Bales 356
Sanford, Arnold B., Substitution of Filling Frames for Mules . 349
Sawyer, J. Herbert, Auditor's Report 74
Sea Island Cotton Ginning . . . 401
Second-hand Machines for Textile Schools, C. P. Brooks . . 145

Secretary's Report 78
Selvedges 227
Sheldon, Frank P., Auxiliary Power Plants with Electrical Transmission 298
Sheldon, Frank P., on Steel Floor Beams 273
Sherman, William F., Discussion on Depreciation 137
Simpson, Louis, Bleaching out Oil Stains 251
Simpson, Louis, Cyclone Separators 287
Simpson, Louis, Experience with Steel Beams 273
Simpson, Louis, Fire Hose . . . 219
Simpson, Louis, on Fires in Dust Flues 221
Simpson, Louis, Investigation of Cotton Fibre 100
Simpson, Louis, Motors at Valleyfield, P. Q. 339
Simpson, Louis, on Piecings . . 255
Simpson, Louis, Receipt for Whitewash 285
Simpson, Louis, Skill Necessary to Make Fine Goods 246
Simpson, Louis, Transportation of Round Bales 370
Sixty-sixth Meeting, Attendance at 51
Sizing, Finishing and Packing Goods, Arthur Parkinson . . 263
Sizing Compounds 234
Sizing for Warps 263
Smith, Robert R., Investigation of Cotton Fibre 100
Smith, Robert R., Large Rolls of Cloth 253
Smith, Robert R., Oil Stains . . 250
Smyth, Capt. Ellison A., Opinion on the Electric Drive 329
Southern Mills, Statistics of . . 351
Special Act of Massachusetts Legislature 4
Spencer, S. S., Committee on Nominations 95
Spindles at the South in 1850 . 144
Spinning Bands, Tension of . . 333
Spinning Frames Driven by Motors 327
Steel Floor Beams 273
Stewart, Robert, Elected an Active Member 92
Strength Testing of Cloth . . . 230
Strength Testing of Cloth . . . 240
Stubbs, Dr., Improvement of Cotton Fibre 390
Subdivision of Electric Power . 332
Subdivision of Labor 107
Sullivan, John, Elected an Active Member 92
Sullivan, Timothy, Elected an Active Member 92
Superintendent, Duties of . . . 113

T

Testimonial Fund 74
Tension of Spindle Band . . . 333
Thomas, Edward W., Automatic Conveying of Cotton from Storehouse to Picker Room . 426
Thomas, E. W., Experience with Electric Motors 344
Thomas, E. W., Permanence of Electric Drive 329
Tidd, Joseph S., Elected an Active Member 92
Tingle, E. W. S., Commerce with Philippines 148
Tinkham, Horace W., Elected an Active Member 93
Topical Question, No. 107 88-145
" " " 108 89-219
" " " 109 89-219

Topical Question, No. 110 90–267
" " " 111 94–273
" " " 112 94–283
" " " 113 95–286
" " " 114 96–98–345
" " " 115 96–98–349
" " " 116 97–356
Topical Questions, List of . . . 61
Trade with the Philippines . . . 148
Transactions of Technical Societies 84
Treasurer's Report 73
Treat, Robert B., Oil Stains . . 252
Tremont & Suffolk Mills 329
Two-phase Electric System . . 302

V

Ventilation of Card Rooms . . . 286
Vice-Presidents, Election of . . 95

W

Wages in 1850 140
Walmsley, Herbert E., Industrial Institutions, Their Organization and Regulation 104
Walmsley, Robinson, Elected an Active Member 93
Ware, Justin A., Discussion on Industrial Institutions 124
Warp Sizing 232
Warren, Arthur J., Elected an Associate Member 93
Washington Mills, Result of Electric Transmission 329
Water and Moisture in Air . . . 261
Weave Rooms, Electric Lights for 346
Weld, Stephen M., Elected an Associate Member 93
Westinghouse Power Plant . . . 299
Whaley, W. B. Smith, Advantages of the Electric Driven Cotton Mill 315
Whitaker, Channing, Power Absorbed by Banding 344
Whitaker, Channing, Power Required for Spinning Frames . 334
White, A. Tenny, Elected Director 95
White, W. W., Elected an Associate Member 93
Whitewash for Mills 283
Whitin, Henry T., Elected Vice-President 95
Wilbur, J. S., Elected an Active Member 93
Wilson, Dr. Wm. P., Cotton Trade With Our Newly Acquired Territories 157
Woodbury, C. J. H., Automatic Sprinklers in Dust Flues . . . 220
Woodbury, C. J. H., English Method of Ventilating Card Rooms 295
Woodbury, C. J. H., Secretary's Report 78
Woodbury, C. J. H., Treasurer's Report 73

Y

Yarn, Average Number, Rule for 179
Young, James M., Elected an Active Member 93

International Trust Company,

45 MILK, Corner of DEVONSHIRE ST.,

BOSTON, MASS.

INTERNATIONAL TRUST COMPANY BUILDING,

45 Milk, Corner of Devonshire St., Boston.

Capital, $1,000,000.
Surplus, $1,500.000.

Transacts a General Banking and Trust Company Business.

This company solicits accounts from Individuals, Firms and Corporations, and those acting in any official or trust capacity, who contemplate making changes or opening new accounts.

Interest Allowed on Deposits Subject to Check.

Commercial and Corporation Paper discounted and Loans made upon approved Security or Collaterals.

Sterling Bills of Exchange drawn on the **LONDON** and **WESTMINSTER** Banks, Limited, London; and Cable Transfers made,

Latest and Improved

Safe Deposit Vaults.

Separate Accommodations for Ladies.

DIRECTORS:

William Claflin, W. Murray Cane,
Robert M. Morse, James Philips, Jr.,
John Hogg, Patrick A. Collins,
Lyman Nichols, John M. Graham,
A. N. Burbank, Thomas F. Temple,
Oliver W. Mink, C. J. H. Woodbury,
William W. Crapo. Aaron Davis Weld,
Albert C. Houghton.

JOHN M. GRAHAM, President
HENRY L. JEWETT, Secretary,
EDWARD H. BURDETT,
Superintendent of Vaults.

KITSON PICKERS

Have been manufactured on the same old spot for nearly 50 Years,

But all you can recognize in visiting Lowell is the spot. There isn't a vestige of the original shop or its equipment remaining.

Everything in the way of spacious buildings, special tools, jigs and templets for constructing this one line of cotton mill machinery strictly on the duplicate system now occupies the old stamping ground, and your inspection of the same is solicited.

Our Cotton Openers and Lappers

Have become a household word among mill men, North and South. Always "up to date" in improvements and "down to date" in price.

Send for new catalogue of Cotton Preparing and Waste Working Machinery.

KITSON MACHINE CO.,

LOWELL, MASS.

STUART W. CRAMER, Southern Agent,

CHARLOTTE, N. C.

Inspection. Protection.

J. M. ALLEN, President.

W. B. FRANKLIN, Vice-President.

F. B. ALLEN, 2d Vice-President.

J. B. PIERCE, Sec'y and Treas.

Northeastern Department,

C. E. ROBERTS, - - Manager,

125 MILK STREET,

BOSTON.

Have you investigated the advantages of

POWER TRANSMISSION

with ropes in comparison with other methods? The large amounts of power safely and economically carried short or long distances indoors or outdoors; vertically or horizontally; at any angle: in small width; with absence of noise and freedom from electrical disturbance; at small first cost and with economy of maintenance.

"PLYMOUTH"

Manila Transmission Rope,

MANUFACTURED BY THE

Plymouth Cordage Company,

was the first rope manufactured in this country especially for Power Transmission, and still continues to be the VERY BEST ROPE made for such use.

BALE ROPE OF ALL KINDS.

Also, Cables, Ropes, Cordage, and Binder Twine of every description.

INSIST

Upon having PLYMOUTH goods, for they are Unequalled.

WRITE FOR PRICES.

Plymouth Cordage Company

NORTH PLYMOUTH, MASS.

G. F HOLMES, TREASURER.

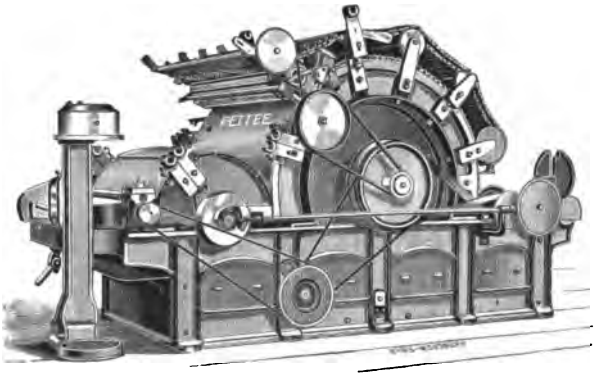
Saco AND Pettee Machine Shops

Main Office: NEWTON UPPER FALLS, MASS.

COTTON MACHINERY

OF THE

LATEST IMPROVED PATTERN.



Revolving Flat Cards, Slubbing,
Railway Heads, Intermediate and
Drawing Frames, Roving Frames.
Spinning Frames.

WORKS: . . . { Biddeford, Maine. Newton Upper Falls, Mass.

Send for estimates and prices.

Freight and Telegraph Address:
SACO, ME.

H. P. GARLAND,
Treasurer.

Loom Picker Co.,

Manufacturers of

Loom Pickers, Loom Harnesses,
Loom Reeds,
Ticking Lug Straps,
Hickory Picker Sticks,
Picker Loops and Picker Leather.

Biddeford, Maine.

T. C. ENTWISTLE,

MANUFACTURER OF

Patent Warping, Balling, and Beaming Machines.

ALSO

All Kinds of Common Expansion Combs for Warpers, Beamers, and Slashers.

AND

TRAVERSE WHEEL CARD GRINDERS FOR AMERICAN OR ENGLISH COTTON, WOOLEN OR WORSTED CARDS.

Cor. Market and Worthen Streets, - - LOWELL, MASS.

COTTON MILLS

By utilizing the waste heat from your flue gasses you are enabled to heat your feed water considerably above boiling point. You can use the most economical condensing auxiliary pumps, with a minimum waste of exhaust, having hot feed water from the economizer You can use the hot water for heating your mill successfully. You can make a SAVING in fuel of 12 per cent. to 20 per cent. You can make a saving in repairs to your boilers. You can increase the efficiency of your plant. HOW? By using a *Green's Economizer.*

A Record:
30,000,000 H. P. in Use.

SAVE FUEL BY USING

GREEN'S ECONOMIZER

SOLE MAKERS IN THE U. S. A.,
THE FUEL ECONOMIZER CO.,
Mattaweawan, N. Y.
BOSTON, 53 State Street.
NEW YORK, 74 Cortlandt Street.

Bleach and Dye Works

By using the hot water from the economizer in your kiers and vats you can save 12 per cent. to 20 per cent. in FUEL. You can save 20 per cent. in TIME in the boiling process. You need never run short of steam. You can have hot feed water for your boilers as well as hot water for your DYE HOUSES. You can do better work with less waste. Less complaint from your Dyer about not having enough steam, and less grumbling from your engineer that the Dye House is using all the steam with general satisfaction all around. HOW? By using *Green's Economizer.*

AMERICAN SUPPLY COMPANY,

Mill Furnishers,

11 and 13 EDDY STREET, - - PROVIDENCE, R. I.

MANUFACTURERS OF

Loom Harness and Reeds.

Mail Harness for Woolen and Worsted Goods.

OAK TANNED LEATHER BELTING.

Loom Pickers and Strapping of all Kinds.

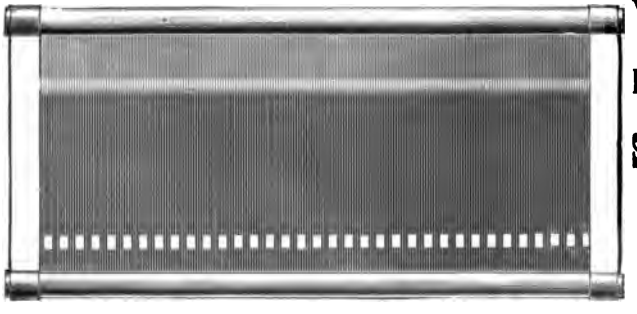
SOLE OWNERS AND MANUFACTURERS OF

Patent Jacquard Heddles.

DEALERS IN

Calf, Sheep and Lamb Roller Skins, Roller and Slasher Cloth and Roll Coverers' Tools.

We have unequalled facilities for furnishing Shuttles, Spools and Bobbins, Wire Heddles and Heddle frames, Spinning Rings and Ring Travelers, Belt Hooks, and Wire Goods of every description.



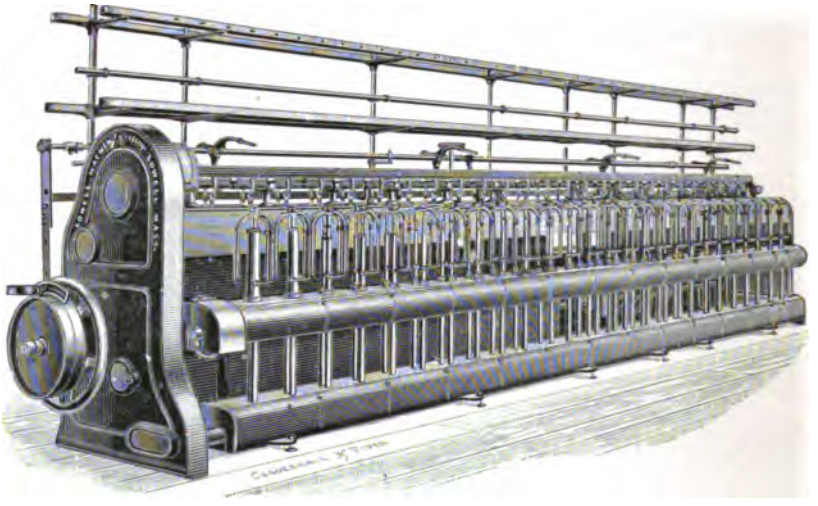
We make a Specialty of
Soldered Reeds for Beaming and Weaving.
Also,
Scotch Tape Leice Reeds,
Thread Leice Reeds
and
Block Leice Reeds.

This Cut Represents our Scotch Tape Leice Reed.

30,000 Looms in City of Fall River Alone Using Our Double Knot Harness.

PELEG W. LIPPITT, PRES. JOHN E. KENDRICK, VICE-PRES.
MYRON FISH, TREAS. JOHN A. CARTER, SEC'Y. JOSEPH H. KENDRICK, AGENT.

Lowell Fly Frame.



This cut represents our latest Improved Fly Frame, with:

New Pattern Compound with Perfect Lubrication.

Rail Motion applied at Centre of Frame, thus dispensing with the dwelling of the rail at each end of traverse.

Fluted Rolls ground the same diameter and geared at both ends.

A simple Doffing Stop Motion and Shipper Gag.

All parts made interchangeable.

Lightest running frame in the Market.

Lowell Machine Shop,

LOWELL, MASS.

The American Drosophore Company.

WM. FIRTH, Manager.

OFFICES:
Equitable Building, 150 Devonshire Street.

WORKS:
22 Medford Street, BOSTON.

FOUR GOLD MEDALS AWARDED.

Amiens,	1894
Atlanta Exposition,	1895
Reims,	1895
The only Humidifier that stood the test.	
Rouen,	1896

The DROSOPHORE makes a perfect Spinning or Weaving atmosphere in any climate or weather. Any degree of humidity is obtainable. Will warm the air in cold weather and cool it in hot weather. Purifies the air and is healthier for the workpeople.

The Gold Medal Double Nozzle Drosophore

Has no wearing parts, uses less water, gives a finer spray and more humidity than any other form of Humidifier.

The above company has delivered since February, 1895, over 7,000 of these machines.

WILLIAM FIRTH,

—— IMPORTER OF ——

TEXTILE MACHINERY,

Equitable Building, 150 Devonshire St., Boston, Mass.

——— SOLE IMPORTER OF ———

Hetherington's Patent Revolving Top-Flat Carding Engines,

Combing Machines, Drawing Frames, Roving Frames and Self-Acting Mules.

Curtis Sons & Co., Patent Worsted Card, Woolen Cards and Mules.

Also, Worsted Machinery, on French and English Systems.

Wm. Tatham & Co., Vulcan Works, Rochedale, England, Makers of Waste Machinery for Working Hard and Soft Waste, Cop Bottoms, etc.

James Yates & Son, Hardened and Tempered Steel Card Clothing for Woolen and Worsted Goods.

JOSEPH STUBBS,

—— MAKER OF ——

Patent Quick Traverse Gassing Frames for Cotton, Worsted, and Silk Yarns; Yarn Preparing Machines; also, Patent Adjustable Yarn Clearer for Winding Frames.

ESTABLISHED 1854.

Thomas Mayor & Son,

BODDEN FLYERS,

Re-arrangement of Machinery for Fine Work.

Over 200,000 Mayor's Improved Bolsters and Flyers applied to old frames.

General Repairs on Roving Machinery.

Pressers for Bodden Flyers always in stock.

PROVIDENCE, R. I.

National Ring Traveler Co.,

MAKERS OF STANDARD

Spinning and Twisting Travelers

OF EVERY DESCRIPTION.

Belt Hooks, Loom Forks, Saddles and Wire Specialties of all Kinds.

PROVIDENCE, R. I.

A. CURTIS TINGLEY, TREASURER.

W. F. Sherman, C. E.,

MILL WORK A SPECIALTY.

Engineer and Constructor of Some of the Best Large Mills and Bleacheries in New England.

Value Estimates for All Purposes Promptly Made.

Room 106 The New Brazer Building, 27 State St., BOSTON, MASS.

FOR a Fly Frame that will give you a large production at small amount of cost and horse power, go to the WOONSOCKET MACHINE & PRESS COMPANY, Woonsocket, R. I. They also manufacture Cloth Trimmers, Shafting, Hangers, Pulleys, Friction Clutches, &c.

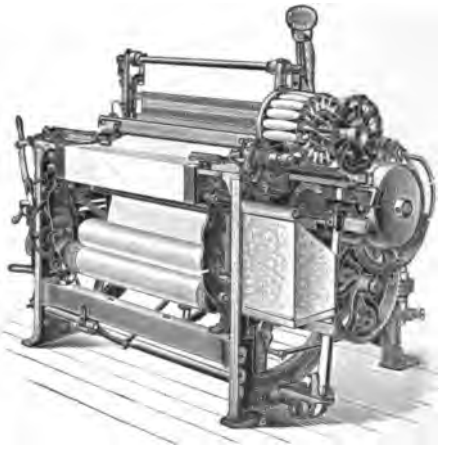
What would you think of a loom

that requires but half the labor,

weaves more perfect cloth

and will run over time

without need for attention?



Our Northrop Loom.

Would you buy it at a price that makes it the cheapest machine ever put in your mill, or would you wait, and doubt, and doubt, and wait, until the competition of the enterprising who were quicker to know a good thing forced you into the line at the rear of the procession?

Some said it was not adapted to their goods. Others went ahead and **tried it,** with the result that it is now satisfactorily weaving on practically all the common grades of cloth.

Some said the cost of repair would kill it. We have signed statements from users, showing its expenses in this line **less** than on their common looms.

Some said it could not make perfect cloth. Why then do buyers specify its product? Print works grade it higher than common loom cloth.

Facts cannot be met by assertion. The 25,000 looms fitted with our devices are an unanswerable argument. The introduction may take time, but we shall make this loom universal in the same way that we have filled mills with our **Spindles, Temples, Spinning Rings, Separators, Twisters, Warpers, Spoolers, etc.**

In all cases the early converts gain the highest proportionate profit.

If interested write

The Draper Company,

HOPEDALE, MASS.

Philadelphia Textile School.

[PENNSYLVANIA MUSEUM AND SCHOOL OF INDUSTRIAL ART.]

SIXTEENTH YEAR.

Instruction given in all branches of the manufacture of

COTTON, WOOL, WORSTED AND SILK

Complete Modern Equipment for CARDING, SPINNING, DYEING, WEAVING and FINISHING.

1899. Day Classes open October 2nd;
Evening Classes open October 9th.

Endorsed by leading Manufacturers and Educators.
Send For Illustrated year book.

EDWARD W. FRANCE, Director. Broad & Pine Sts., Philadelphia,

JOSIAH GATES & SONS,

— MANUFACTURERS OF —

Oak Tanned Leather Belting,

Lace Leather, Worsted Apron Leather,

Picker Leather,

Loom Strapping and Worsted Aprons.

Rubber Belting and Mill Supplies.

307 Market Street, Lowell, Mass.

S. A. Felton & Son Co.,

Mill Brushes.

FACTORY:
MANCHESTER, N. H.

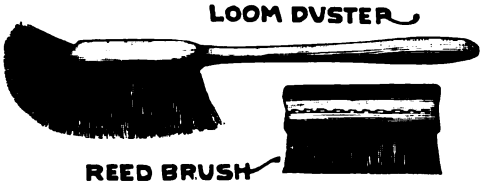
BOSTON OFFICE:
19 HIGH STREET.

REVOLVING FLAT CARD BRUSHES

TO FIT ANY MAKE MACHINE.

Comber Brush.

PRINT WORKS FURNISHERS



Made by

An Improved Method.

Bottle Brush.

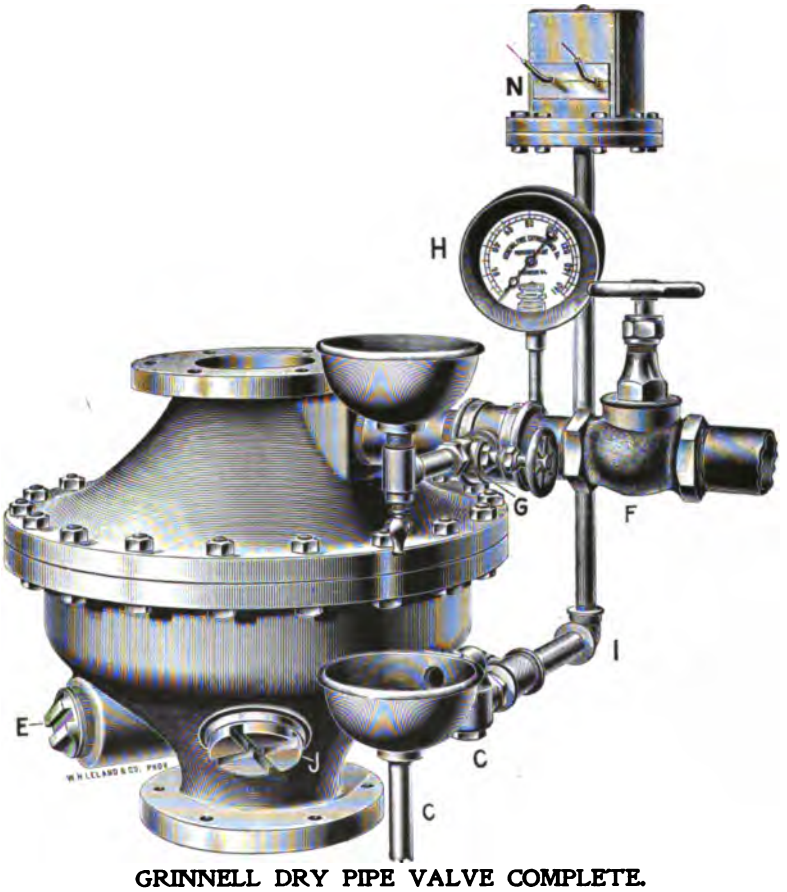
All Kinds of Brushes for Cotton and Woolen Mills.

Estimates made on Special Work pertaining to Mill Brushes.

General Fire Extinguisher Co.

Manufacturers, Jobbers and Dealers in PIPE, FITTINGS, VALVES, HYDRANTS, and all kinds of Steam, Gas and Water Supplies and Specialties.

Factories and Warehouses equipped with the GRINNELL AUTOMATIC SPRINKLER, on the wet pipe or dry pipe system, as may be desired.



GRINNELL DRY PIPE VALVE COMPLETE.

The Grinnell Dry Pipe System affords thorough protection all the year round for buildings in which the water in a wet pipe system would freeze.

Information and proposals furnished at the Several Department Agencies, and at the

Executive Offices, PROVIDENCE, R. I.

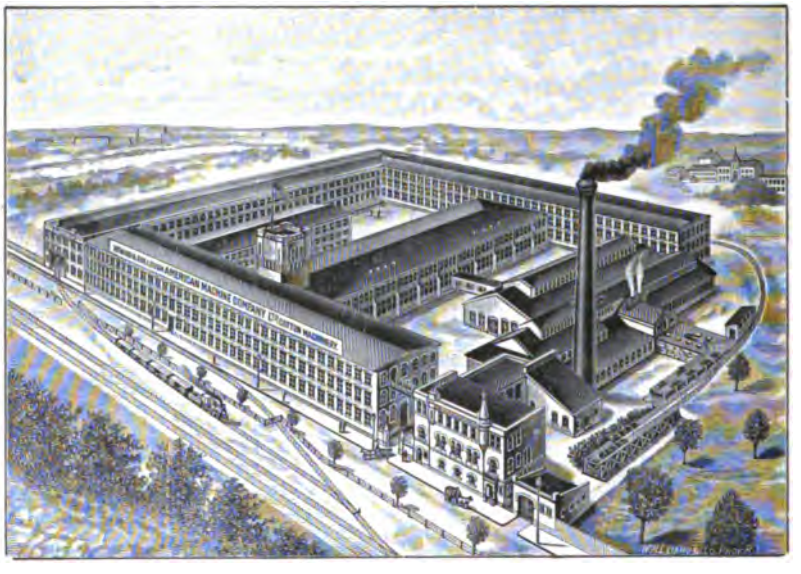
HOWARD & BULLOUGH

American Machine Co., Ltd.

PAWTUCKET, R. I.,

BUILDERS OF

COTTON MACHINERY.



BALE BREAKERS, FEEDERS,
SELF FEEDING OPENERS,
BREAKER, INTERMEDIATE and
FINISHER LAPPERS.

REVOLVING FLAT CARDS,
DRAWING FRAMES { with Mechanical or Electrical Stop-motions.
SLUBBING, INTERMEDIATE and
ROVING FRAMES.

NEW PATTERN SPINNING FRAMES.

We invite investigation and comparison.

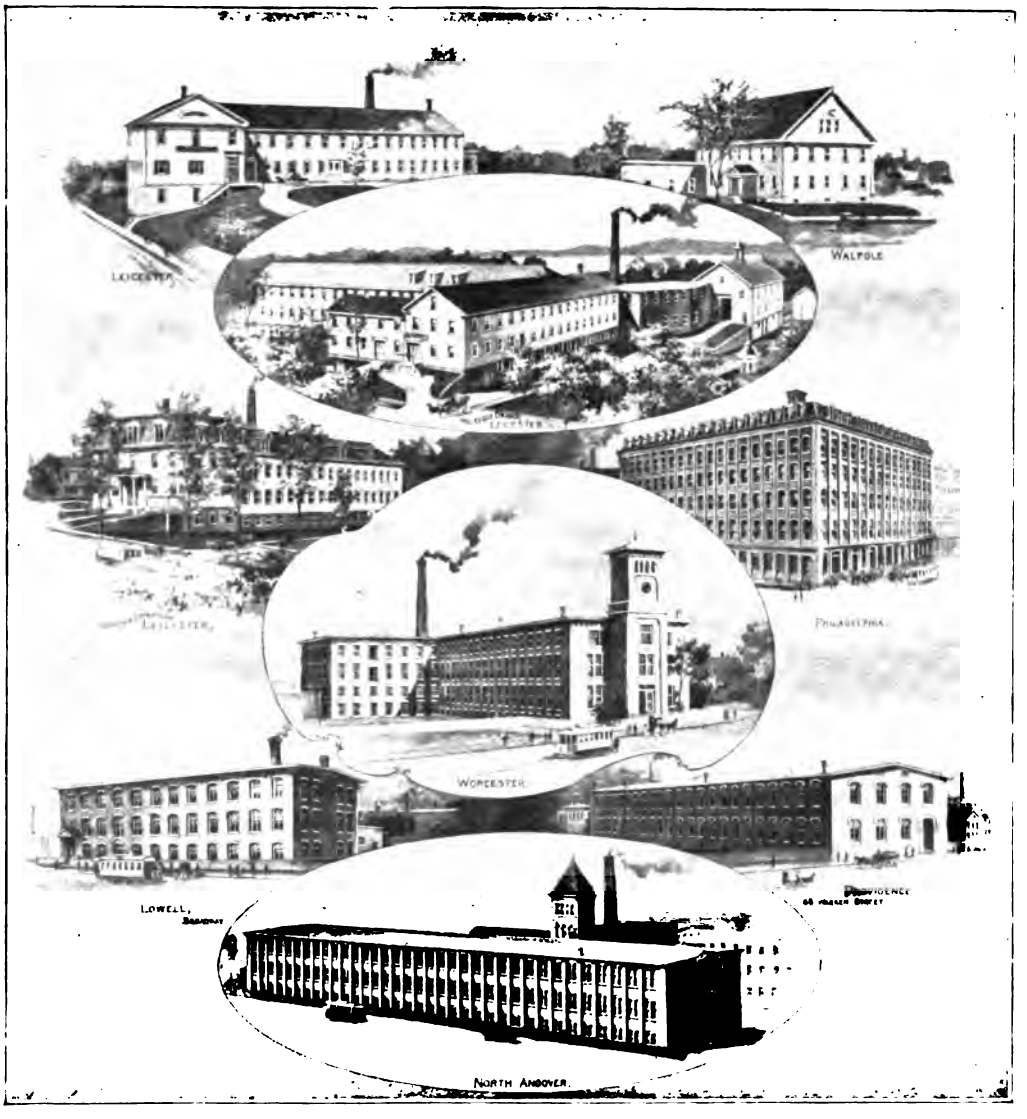
INCORPORATED JUNE 4, 1890.

American Card Clothing Co.

GENERAL OFFICES: Worcester, Mass.

SEND ORDERS TO FACTORIES:

Worcester, Leicester, North Andover, Lowell, Walpole, Mass., Philadelphia, Pa., Providence, R. I., Manchester, N. H.



Manufacturers of Every Description of CARD CLOTHING.

Special attention given to Clothing for Revolving Top Cards. Experts furnished to Clothe and Start the same.

Hardened and Tempered Steel Wire Card Clothing, Plough Ground or Surface Ground. Revolving Top Flats covered and fastened with Steel Clips.

Southern Branch Office, Durham Block, Charlotte, N. C.

The J. R. MONTGOMERY CO.,

WINDSOR LOCKS, CONN.,

MANUFACTURE

Mercerized Cotton Spinning Bands.

Will not Shrink nor Stretch.

Are not Affected by Dry or Humid Atmosphere.

Are Fifty per cent. Stronger than Ordinary Bands.

Will last twice as long.

Can be put on lightly and greatly reduce the power required to drive spinning machines.

ALSO MANUFACTURE

MERCERIZED COTTON YARNS, which give the high silk lustre.

The Philadelphia Commercial Museum

DR. WILLIAM P. WILSON, Director.

SUPPLIES DETAILED, SPECIFIC INFORMATION concerning the TRADE CONDITIONS of the WORLD'S MARKETS.

It tells WHERE THE MARKETS ARE and by whom supplied.

Who the RESPONSIBLE BUYERS ARE and HOW TO REACH THEM.

It can ascertain FOR YOU the particular REQUIREMENTS of any or all markets in THE LINE OF GOODS YOU MAKE.

It has inaugurated a most valuable method of REGISTERING AMERICAN MANUFACTURERS in Foreign Countries by means of

CARD INDEX FILES

PLACED IN THE CHAMBERS OF COMMERCE IN FORTY-FIVE OF THE PRINCIPAL COMMERCIAL CENTERS OF THE WORLD.

This is a movement in the Interest of American Commerce with which YOU SHOULD BE IDENTIFIED.

Write for particulars to

THE PHILADELPHIA COMMERCIAL MUSEUM,

233 SOUTH FOURTH STREET, PHILADELPHIA, PA.

DODGE M'F'G. CO.

MISHAWAKA, IND.

POWER TRANSMITTING MACHINERY

DODGE PATENT AMERICAN SYSTEM
—OF—
ROPE TRANSMISSION

INDEPENDENCE WOOD SPLIT PULLEYS

SELF OILING HANGER BEARINGS

SPECIAL TEXTILE MILL PULLEYS

BRANCH HOUSES

BOSTON
137-139 PURCHASE ST.

NEW YORK

CHICAGO

ELECTRICITY

IN MILLS AND FACTORIES

Has been made a special study by our Engineers. The most important factories in this country driven by electricity are equipped with our apparatus.

WEAVE ROOM, PONEMAH MILLS, TAFTVILLE, CONN.
Driven by General Electric Motors Operated by Electricity Transmitted 4½ Miles.

All our expert information is available to Mill Engineers and Superintendents.

GENERAL ELECTRIC CO.

Principal Office, SCHENECTADY, N. Y.

SALES OFFICES: **BOSTON, 180 SUMMER STREET,**
NEW YORK, 44 BROAD STREET,

AND ALL LARGE CITIES IN THE UNITED STATES.

Stoddard, Haserick, Richards & Co.

BOSTON, MASS. BRADFORD, ENGLAND.

Bankers and Importers.

Sole Representatives for:

DOBSON & BARLOW, Ltd., - - - Bolton.

Improved Bi-Simplex Carding Engines, with Patent Anti-Flexion Grinder.
Heilman Combs, Single and Duplex.
Ribbon Lap Machines. Sliver Lap Machines.
Slubbers, Intermediates, Rovers and Jacks.
Improved Self-Acting Mules for Cotton.
Gassing Frames and Winders.
SPECIAL Opening and Picking Machinery for Delicate Cottons.
SPECIAL attention given to Medium and Fine Counts.
WORSTED CARDING ENGINES.
WORSTED MULES.

SAMUEL LAW & SONS, Ltd., - - Cleckheaton.

CARD CLOTHING OF ALL DESCRIPTIONS.

TAYLOR, WORDSWORTH & CO., - - Leeds.

NOBLE COMBS and BACKWASHERS.

PRINCE SMITH & SON, - - - - - Keighley.

WORSTED DRAWING and SPINNING MACHINERY.
BRADFORD SYSTEM and CONE SYSTEM.

SOCIÉTÉ ALSACIENNE, - - - Mulhouse.

WORSTED DRAWING on FRENCH SYSTEM.

EGYPTIAN COTTON.

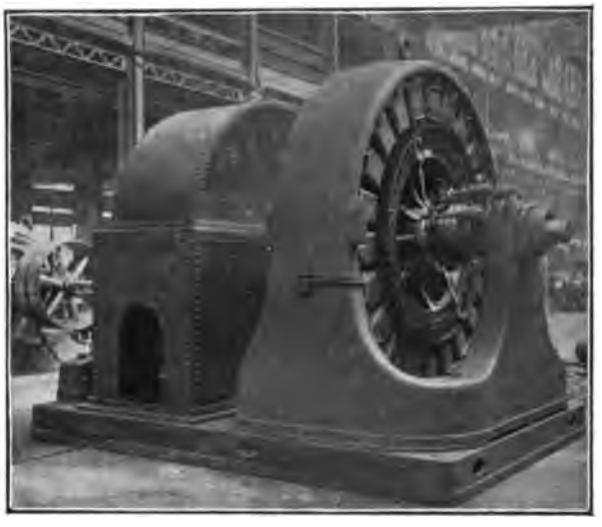
FROM

CARVER & CO., - - - - - Alexandria.

CARVER BROS. & CO., - - - Liverpool.

Westinghouse
Polyphase System

The Best for



Factory and Mill Service.

Polyphase Generator Direct Connected to Pelton Water Wheel.

Our Type "C" Motor.

More in Use Than All Other Makes of Induction Motors Combined.

No Fire Risk.

No Moving Contacts.

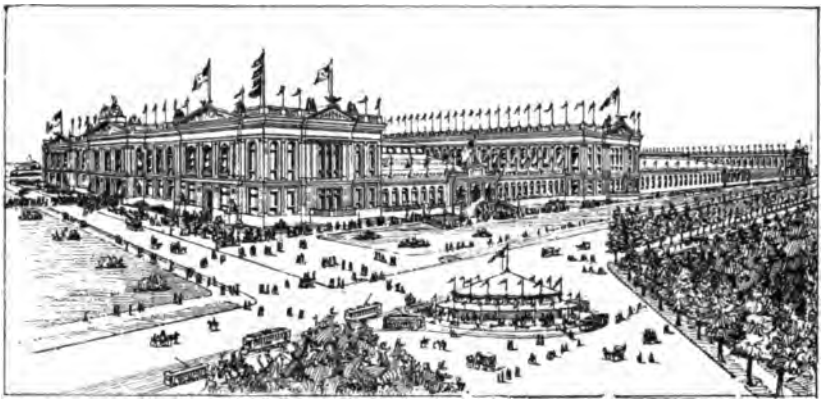
Type "C" Induction Motor.

Westinghouse Electric
and Mfg. Co., Pittsburg, Pa.

Westinghouse Electric Co., L't'd.,
32 Victoria St., London.

And all Principal Cities in United States and Canada.

303A



MAIN BUILDING. Area of Floor Space, 12 Acres.

National Export Exposition

For the Advancement of American Manufactures and the Extension of Export Trade.

PHILADELPHIA, September 14 to November 30, 1899

THE NATIONAL EXPORT EXPOSITION is an Exposition of American Manufactures for the Expansion of Export Trade, and it will be the first National Exposition of that character ever held in the United States.

IT IS UNDER the auspices of the Philadelphia Commercial Museum and the Franklin Institute, two great public Institutions in Philadelphia, whose standing is such as to assure its success.

SANCTION AND FINANCIAL SUPPORT have been given to the Exposition by the National Government, the State of Pennsylvania and the City of Philadelphia.

EVERY LINE of American manufactured products which is, can or might be exported will be exhibited.

THERE IS ALSO a department of foreign manufactured goods, consisting of collections of samples of goods made in the commercial countries of Europe and successfully sold in all foreign markets.

THESE SAMPLES will show our manufacturers just what competition they must meet as well as the peculiarities in the demands of every foreign market.

A THIRD DEPARTMENT will show how American goods must be packed, labeled and shipped, in order to meet the requirements of foreign trade.

ON OCTOBER 10th an International Commercial Congress will convene in the Exposition Auditorium, in connection with the meeting of the International Advisory Board of the Philadelphia Commercial Museum.

DELEGATES FROM many Foreign Governments and from Chambers of Commerce and other commercial organizations all over the world will be present.

THE PHILADELPHIA COMMERCIAL MUSEUM has also invited 20,000 foreign business houses with which it is in close correspondence, to send representatives to the Exposition.

AN EPITOME of the manufactured products of the United States, of the highest grade and quality which American genius, skill and experience can produce, will be displayed at the Exposition for the inspection and study of these foreign delegates and buyers.

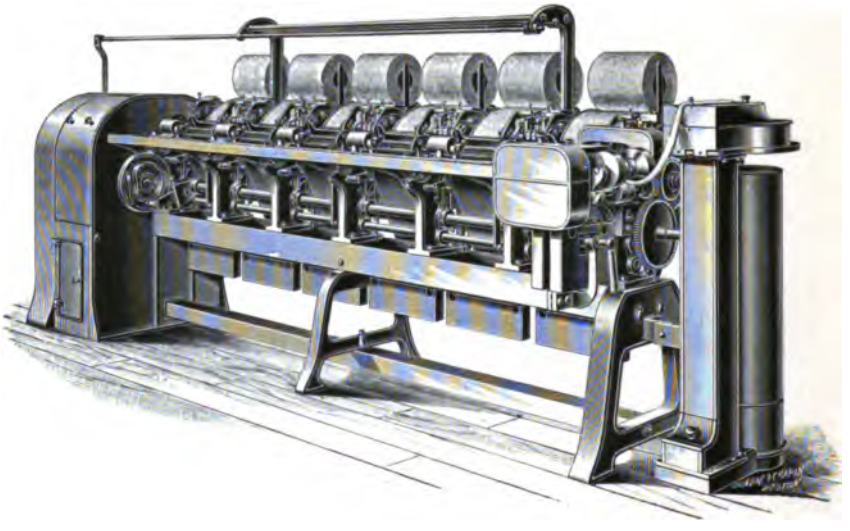
W. P. WILSON, Director-General,
233 South Fourth Street, PHILADELPHIA, PA.

MASON MACHINE WORKS,

TAUNTON, MASS.,

——BUILDERS OF——

COTTON MILL MACHINERY.



MASON COMBER.

REVOLVING FLAT CARDS, 40 and 45 Inch.
COMBERS, SLIVER and RIBBON LAP MACHINES.
RAILWAY HEADS and DRAWING FRAMES.
SPINNING FRAMES, for Coarse or Fine Yarns.
MULES, for Coarse or Fine Yarns.

Over 2,000,000 Spindles of MULES Built to Date.

LOOMS IN GREAT VARIETY, PLAIN OR FANCY.

Also, THE MASON NORTHROP LOOM.

Southern Agents, THE D. A. TOMPKINS CO., Charlotte, N. C.

"Unrolls Like a Carpet."

THE

AMERICAN COTTON COMPANY'S

ROUNDLAP BALE,

besides its many other economies, saves the first processes of cotton manufacture.

It unrolls directly into the lapper, and dispenses with the ordinary operations of opening and mixing.

It occupies but 55 per cent. of the warehouse space, weight for weight, taken up by the square compress bale, the expense of handling is less than that of the latter and the elements of risk and waste from loose cotton, always present with square bales, are removed.

Someone has well named it the Salamander bale. It is almost fireproof and reduces the fire hazard to the minimum. The air having been compressed from the bales, fire cannot strike in, and goes out for lack of something to feed on. Roundlap bales are also impervious to water.

The fibre of Roundlap baled cotton is stronger, the cotton cleaner than square baled and the tare is only 1 per cent.

Every bale is plainly marked and is accompanied by a guaranteed sample. Further information as to machinery or cotton will be supplied on application to the American Cotton Company.

Roundlap bales can be bought of The American Cotton Company in New York or of any of its agents, or they can be purchased by any cotton buyer or by any mill at the gin plants, a complete list of which will be furnished on application.

THE AMERICAN COTTON COMPANY.

Capital, - - - $7,000,000.

General Offices, 27 William St., New York City.

JNO. E. SEARLES, President, New York.
WM. C. LOVERING, Vice-President, Boston.
WINTHROP M. TUTTLE, Treasurer, New York.
GEORGE W. OAKLEY, Secretary, New York.

DAVID S. JOHNSTON, Treas. JEROME GARLAND, Mgr.

THE

Cohoes Iron Foundry and Machine Co.,

COHOES, N. Y.

— MANUFACTURERS OF —

Cylinder and Hot Air Slashers.

The Cylinder Slashers are made with One Cylinder, Two Cylinders or Three Cylinders each, and can be made with One, Two or Three Size Boxes, for Plain or Colored Work. . . . . .

We also make a Slasher with a Headway to accommodate Two Loom Beams at the same time, which is very desirable for a large production of Print Cloth or for Very Fine Yarn. . . . . .

Size Tanks, Tramways and all Slasher-room Necessities.

In addition to our Slasher Work, we make Elevators and Snow's Improved Water Wheel Governors. Also repairs for the Parr, Curtis & Madeley Mules, and the John Mason Frames. . . . . .

E. A. SMITH, PRESIDENT. J. P. WILSON, SEC'Y AND TREAS.

THE CHARLOTTE SUPPLY COMPANY,

GENERAL MILL FURNISHERS

.....And Manufacturers of Leather Belting.

CHARLOTTE, N. C.

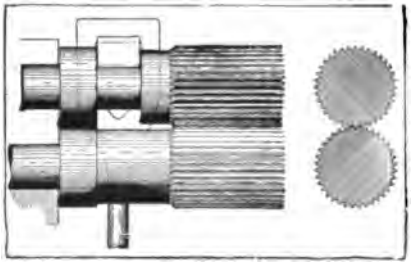
The Metallic Drawing Roll Co.

—— SOLE MANUFACTURERS OF ——

Patent Metallic Rolls

FOR FIBROUS MATERIALS.

25 Per Cent. More Production Guaranteed, at Less Cost.



Applied to any make of machine, new or old, and successfully on the following Carding Room Machinery:

Coiler Railways.
Sliver Lap Machines.
Comber Draw Box.

Drawing Frames, with Electric or Mechanical Stop Motion.

Slubbers.
Intermediate Frames.

WRITE FOR PRICES AND PARTICULARS TO

THE METALLIC DRAWING ROLL CO., Indian Orchard, Mass.

Providence Engineering Works,

PROVIDENCE, R. I.

Successors to PROVIDENCE STEAM ENGINE COMPANY, also to RICE & SARGENT ENGINE COMPANY, for U. S. A.

Having acquired the sole right to manufacture

RICE & SARGENT ENGINES, and IMPROVED GREENE ENGINES,

We are in position to meet all requirements as to Economy, Regularity of Speed, Strength, and Durability. Send for quotations.

Crompton & Knowles Loom Works,

WORCESTER, MASS.

—— BUILDERS OF ——

GINGHAM LOOM.

Plain and Fancy Cotton Looms.

Branch Works, - - Providence, R. I.

And Weaving Machinery for Every Kind of Textile Fabric.

ALSO MAKERS OF

Dobbies and Jacquards.

PLAIN COTTON LOOM.

AN INTELLIGENT AND CAREFUL

INSPECTION

IS THE BEST

PROTECTION.

Mutual Boiler Insurance Company

OF BOSTON.

POLICIES COVER DAMAGE TO PROPERTY AND EMPLOYEES.

Specifications Given for Boilers and Settings.

DIRECTORS.

EDWARD ATKINSON, GEO. W. WHEELWRIGHT, CHAS. F. FAIRBANKS,
J. W. FARWELL, HARCOURT AMORY, A. B. SILSBEE,
A. M. GOODALE, HERBERT LYMAN, JAS. S. MURPHY,
MOSES WILLIAMS, JR., ROBERT BATCHELLER, JOHN C. COBB.

EDWARD ATKINSON, President. D. W. LANE, Secretary and Treasurer.
R. S. HALE, Consulting Engineer.

Telephone, 443 Boston. **31 MILK STREET, BOSTON.**

A 29
A 1 2 C

TRANSACTIONS

OF THE

New England

COTTON MANUFACTURERS' ASSOCIATION.

Founded April 20, 1865. Incorporated Dec. 1, 1894.

NO. 66.

ANNUAL MEETING.

Held in Chipman Hall, 88 Tremont Street, Boston, Mass.,

APRIL 27-29, 1899.

Office of the Association:

Room 57, International Trust Building, 45 Milk Street,
Corner of Devonshire St., Boston, Mass.

WALTHAM, MASS.
TRADE OF [illegible] PRESS,
1899.

AUG 9 1909